

INVITATION FOR BIDS

(IFB)

ACCESS CONTROL POINT

FORT IRWIN, CALIFORNIA

**IFB NO.
SPECIFICATION NO.
DRAWING FILE NO.**

**DACA09-03-B- 0007
1309
238-25-477**



**US ARMY CORPS OF ENGINEERS
Los Angeles District**

**DIRECTIVE NO.
PROJECT NO.**

**#6 DATED 26 NOV 2002
59117**

**ACCESS CONTROL POINT
FT. IRWIN, CA.**

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SOLICITATION, OFFER, AND AWARD <i>(Construction, Alteration, or Repair)</i>		1. SOLICITATION NO. DACA09-03-B-0007	2. TYPE OF SOLICITATION <input checked="" type="checkbox"/> SEALED BID (IFB) <input type="checkbox"/> NEGOTIATED (RFP)	3. DATE ISSUED 25 July 2003	PAGE OF PAGES
IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.					
4. CONTRACT NO.		5. REQUISITION/PURCHASE REQUEST NO.		6. PROJECT NO.	
7. ISSUED BY Los Angeles District, COE CESPL-CT-West Region Branch P. O. Box 532711 Los Angeles, CA 90053-2325		8. ADDRESS OFFER TO Los Angeles District, COE CESPL-CT-West Region Branch P. O. Box 532711 Los Angeles, CA 90053-2325			
9. FOR INFORMATION CALL		A. NAME Lucia A. Carvajal		B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS) 213.452.3240	

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying no., date):

MAIN ACCESS CONTROL POINT, FORT IRWIN, CALIFORNIA

The project consists of modernization of the Main Access Control Point at FT Irwin, California, to meet Department of Defense force protection requirements. The Scope of Work consists of extensive site improvement to provide 4 lanes of vehicular traffic with a separate lane for large vehicles. It includes additional 3 guard booths on concrete pads, close circuit TV cameras to monitor all ACP lanes, significant lighting both in approached and in the immediate inspection areas to provide for adequate surveillance of vehicular traffic during hours of darkness, necessary standby power generation with sufficient capacity to power all communication equipment, as well as lighting in the approach areas and the immediate inspection areas.

The Small Business Administration has determined that for this procurement, competition will be restricted to eligible 8(a) contractors serviced by the Santa Ana District of the Small Business Administration which have a NAICS code of 236220 among their approved NAICS codes.

The estimated cost range of this acquisition is \$1,000,000.00 - \$5,000,000.00.

Please Note: This procurement may be delayed, cancelled, or revised at any time during the solicitation, evaluation, and/or final award process.

11. The Contractor shall begin performance within * calendar days and complete it within * calendar days after receiving <input type="checkbox"/> award, <input checked="" type="checkbox"/> notice to proceed. This performance period is <input checked="" type="checkbox"/> mandatory, <input type="checkbox"/> negotiable. (See * Section 00800 .)	
12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? (If "YES," indicate within how many calendar days after award in Item 12B.) <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	12B. CALENDAR DAYS 10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and 0 copies to perform the work required are due at the place specified in Item 8 by 1:00 PM (hour) local time
 26 August 2003 (date). If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee ☒ is, ☐ is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than 60 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER (Must be fully completed by offeror)

14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)

15. TELEPHONE NO. (Include area code)

16. REMITTANCE ADDRESS (Include only if different than Item 14)

CODE

FACILITY CODE

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within _____ calendar days after the date offers are due. (Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.

AMOUNTS

Please refer to the Price Schedule.

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS

(The offeror acknowledges receipt of amendments to the solicitation - give number and date of each)

AMENDMENT NO.

DATE

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER
(Type or print)

20B. SIGNATURE

20C. OFFER DATE

AWARD (To be completed by Government)

21. ITEMS ACCEPTED:

22. AMOUNT

23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN
(4 Copies unless otherwise specified)

ITEM

25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO

☐ 10 U.S.C 2304(c) ()☐ 41 U.S.C 253(c) ()

26. ADMINISTERED BY

CODE

27. PAYMENT WILL BE MADE BY

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT Contractor is required to sign this

document and return _____ copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all work requirements identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.

☐ 29. AWARD (Contractor is not required to sign this document.) Your offer

on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED
TO SIGN (Type or print)

31A. NAME OF CONTRACTING OFFICER (Type or print)

30B. SIGNATURE

30C. DATE

31B. UNITED STATES OF AMERICA

BY

31C. AWARD
DATE

CONTINUATION OF STANDARD FORM 1442

BLOCK 20D:

(1) IF THE OFFEROR IS A JOINT VENTURE, EACH PARTICIPANT IN THE JOINT VENTURE MUST COMPLETE THE FOLLOWING:

_____ Company Name	_____ Signature	_____ Title
_____ Company Name	_____ Signature	_____ Title
_____ Company Name	_____ Signature	_____ Title

NOTE: If a corporation is participating as a member of a Joint Venture, the certificate below must also be completed and signed.

CORPORATION AUTHORIZATION TO PARTICIPATE IN JOINT VENTURE CERTIFICATE

I, _____, certify that I am the Secretary of the
corporation
(name)
named as a participant in a Joint Venture on this offer; that
_____, who signed said offer on behalf of the corporation,
was
(name)
then _____ of said corporation; that the signature thereto
is
(title)
genuine; that said contract was duly signed, sealed and attested for and in
behalf of said corporation by authority of its governing body; and that the
corporation is authorized to participate in the Joint Venture on this offer.

(Name of Corporation)

(Secretary)

(2) IF THE OFFEROR IS A PARTNERSHIP, LIST FULL NAME OF ALL PARTNERS BELOW. SIGNATURES BY ALL PARTNERS HERE SIGNIFY THAT THE INDIVIDUAL WHO SIGNED THE OFFER IN BLOCK 20B HAS THE AUTHORITY TO BIND THE PARTNERSHIP.

_____ Name	_____ Signature
_____ Name	_____ Signature
_____ Name	_____ Signature

(3) IF THE OFFEROR IS A CORPORATION, THE OFFER SHALL BE SIGNED IN THE CORPORATE NAME FOLLOWED BY THE WORD "BY" AND THE SIGNATURE OF THE PERSON AUTHORIZED TO SIGN THE OFFER IN BLOCK 20B. PROVIDE PROOF THAT THE PERSON SIGNING FOR THE CORPORATION HAS THE AUTHORITY TO BIND THE CORPORATION BY COMPLETING THE FOLLOWING CERTIFICATE:

CONTINUATION OF STANDARD FORM 1442

CORPORATION AUTHORIZATION CERTIFICATE

I, _____, certify that I am the Secretary of the

_____ (name)
corporation named as offeror in the within offer; that

_____, (name)
who signed said offer on behalf of the corporation, was then

_____ of said corporation, that the signature
(title)
thereto is genuine; that said contract was duly signed, sealed and attested
for in behalf of said corporation by authority of its governing body.

(Name of Corporation)

(Secretary)

(4) IF THE OFFEROR IS AN INDIVIDUAL DOING BUSINESS AS A FIRM, THE OFFER
SHALL BE SIGNED BY THAT INDIVIDUAL IN BLOCK 20B FOLLOWED BY THE WORDS "AN
INDIVIDUAL DOING BUSINESS AS _____ (INSERT
NAME OF FIRM).

(5) WHEN AN AGENT SIGNS THE OFFER, PROVIDE PROOF OF THE AGENT'S AUTHORITY TO
BIND THE PRINCIPAL.

PRICING SCHEDULE

BASE SCHEDULE

CONTRACTOR SHALL FURNISH ALL PLANT, LABOR, MATERIAL, EQUIPMENT, ETC. NECESSARY TO PERFORM ALL WORK IN STRICT ACCORDANCE WITH THE TERMS AND CONDITIONS SET FORTH IN THE CONTRACT TO INCLUDE ALL ATTACHMENTS THERETO.

LINE ITEM NO.	DESCRIPTION	QUANTITY	UNIT OF MEASURE	UNIT PRICE	TOTAL PRICE
0001	Construct Access Control Point to the 2 meter Building Line, Complete. (Except as noted below)	1	JOB	LUMP SUM	\$_____
0002	Site Work, Utilities and Infrastructure Outside the 2 Meter Building Line, Complete (Except as noted below)	1	JOB	LUMP SUM	\$_____

TOTAL BASE PRICE \$ _____
(LINE ITEM 0001
THRU ITEM 0002)

OPTION

0003	CONSTRUCT 1620 LINEAL FEET OF 20 " HIGH, INTEGRALLY COLORED PORTLAND CEMENT CONCRETE BARRIER AS INDICATED WITH DETAIL 8 ON SHEET C5.02. THE LOCATION OF THE BARRIER IS SHOWN ON SHEET C1.42. 1	1	JOB	LUMP SUM	\$_____
------	--	---	-----	----------	---------

TOTAL PRICE \$ _____
(LINE ITEM 0001
THRU 0003)

1. Prices must be submitted on all individual items of this Pricing Schedule. Failure to do so may be cause for rejection of bids.

2. If a modification to a price is submitted which provides for a lump sum adjustment to the total price, the application of the lump sum adjustment to each item in the Pricing Schedule must be stated. If it is not stated, the bidder/offeror agrees that the lump sum adjustment shall be applied on a pro rata basis to every item in the Pricing Schedule.

3. The bidder/offeror shall distribute his indirect costs (overhead, profit, bond, etc.) over all the items in the Pricing Schedule. The Government will review all submitted Pricing Schedules for any unbalancing of the items. Any submitted Pricing Schedule determined to be unbalanced may be considered nonresponsive and cause the bidder to be ineligible for award.

4. The lump sum, "LS", line items above are not "estimated quantity" line items and therefore are not subject to the Variation in Quantity contract clause.

5. EFARS 52.214-5000 ARITHMETIC DISCREPANCIES (MAR 1995)

(a) For the purpose of initial evaluation of bids/offers, the following will be utilized in resolving arithmetic discrepancies found on the face of the Pricing Schedule as submitted by bidders/offerors:

- (1) Obviously misplaced decimal points will be corrected;
- (2) Discrepancy between unit price and extended price, the unit price will govern;
- (3) Apparent errors in extension of unit prices will be corrected;
- (4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purpose of bid/offer evaluation, the Government will proceed on the assumption that the bidder/offeror intends the bid/offer to be evaluated on basis of the unit prices, the totals arrived at by resolution of arithmetic discrepancies as provided above and the bid/offer will be so reflected on the abstract of bids/offers.

(c) These correction procedures shall not be used to resolve any ambiguity concerning which bid/offer is low.

6. The successful bidder/offeror grants the options listed in the Pricing Schedule to the Government. **This option may be exercised any time up to 210 days after receipt of Notice to Proceed.** Exercise of the option occurs upon mailing of written notice to the Contractor. Exercise will be made by the Contracting Officer. The price for exercise of the option includes all work and effort associated with the scope of that item. For determination of lowest bid, see paragraph titled EVALUATION OF OPTIONS in Section 00100 of this solicitation. **No additional time for contract completion will be allowed when an option is exercised. The given contract completion time was formulated to include time necessary to perform all option work.**

Section 00100
Bidding Schedule/Instructions to Bidders

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CLAUSES INCORPORATED BY FULL TEXT

52.0000-4010 INQUIRIES

Perspective bidders/offerors should submit inquiries related to this solicitation by writing or calling the following (collect calls will not be accepted:

(1) For inquiries of a contractual nature (solicitation requirements, interpretation of contractual language) call:

Lucia Carvajal

213-452-3240

(2) For inquiries of a technical nature (specification or drawings) call:

Larry Gitting

916-557-7215

(3) Please include the solicitation number, project title and location of project with your questions. Written inquiries must be received by this office not later than 7-calendar days prior to bid opening date/date set for receipt of offers.

52.0000-4023

SAFETY REQUIREMENTS

The bidder's attention is directed to the latest version of U.S Army Corps of Engineers Safety and Health Manual, EM 385-1-1, which will be strictly enforced. This publication may be obtained from the US Army Engineer District, Los Angeles, ATTN: Safety Office, P.O. Box 532711, Los Angeles, California 90053-2325.

52.0001-4004

BID RESULTS

The telephone number for bid results after the opening is Area Code (213) 452-3235.

52.0214-4500

Include in all solicitations

ARITHMETIC DISCREPANCIES EFARS 52.214-5000

(a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face

of the bidding schedule as submitted by bidders:

- (1) Obviously misplaced decimal points will be corrected;
- (2) Discrepancy between unit price and extended price, the unit price will govern;
- (3) Apparent errors in extension of unit prices will be corrected;
- (4) Apparent errors in addition of lump sum and extended prices

will be corrected.

(b) For the purpose of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of the unit prices, the totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

(c) These correction procedures shall not be used to resolve any ambiguity concerning which bid is low.

(End of statement)

52.0214-4583

TELEGRAPHIC BIDS/OFFERS

TELEGRAPHIC BIDS/OFFERS ARE NOT ACCEPTABLE

Any telegram to modify or withdraw a bid/offer sent to this office must be physically delivered to the office designated for receipt of bid/offer by the date and time set for bid opening/receipt of proposals.

No one from this office will be dispatched to the local telegraph office to pick up any telegram for any reason.

52.0214-4584

FACSIMILE BIDS/OFFERS

Facsimile bids/offers, modifications thereto, or cancellations of bids/offers will not be accepted.

52.0214-4599

Use this clause if there are no option items or if the evaluation is inclusive of options.

EVALUATION FOR AWARD

The Government contemplates award of one contract to the responsive, responsible bidder who submits the low bid for the total of all the items in the Bidding Schedule.

52.228-4506 INDIVIDUAL SURETIES IN SUPPORT OF BID BONDS

Bidder/offers utilizing individual sureties in support of a bid bond shall include a Standard Form (SF) 28 (Affidavit of Individual Surety), accompanied by a pledge of acceptable assets from each person acting as an individual surety, and include these with the SF 24 (Bid Bond), and the bid itself (see clause titled "Pledges of Assets," FAR 52.228-11).

Pledges of acceptable assets shall be in the form of (1) evidence of an escrow account and/or (2) a recorded lien on real estate. If this is an RFP, failure to provide required documentation described herein may cause the offeror to be deemed "unacceptable".

52.228-4507 BID GUARANTEE FORM AND AMOUNT

When bids/proposals exceed \$100,000, the offeror shall furnish a separated bid guarantee in accordance with the solicitation provision titled "Bid Guarantee", FAR 52.228-1. In accordance with FAR 28.101-2 the bid guarantee amount shall be a least 20 percent of the "bid price" but shall not exceed \$3 million. When the penal sum is expressed as a

percentage, a maximum dollar limitation may be stated. If there are option line items on the Pricing Schedule (Schedule B), the term "bid price" is hereby defined as the total bid not to include any amount for line items designated as "options". In bids/proposals that contain "additives", the "bid price" is defined as the total of all bid items including additive line items. FAR 28.106-1 states that a Standard Form (SF) 24 shall be used for the bid bond. In accordance with FAR 28.202(a)(1), corporate sureties utilized must appear on the list contained in the Department of Treasury Circular 570 titled "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and Acceptable Reinsuring Companies."

52.0215-5000 DIRECTIONS FOR SUBMITTING OFFERS (MAR 2002)

Envelopes/packages containing offers must be sealed, marked and addressed as follows:

MARK ENVELOPES/PACKAGES:

Solicitation No. **DACA09-03-B-0007**

Closing Date: **19 AUG 2003**

Closing Time: **1:00PM**

ADDRESS ENVELOPES/PACKAGES TO:

Department of the Army
U. S. Army Engineer District, Los Angeles
ATTN: Contracting Division
C/O: **LUCIA CARVAJAL/CINDY MYRTETUS**
P. O. Box 532711
Los Angeles, CA 90053-2325

SPECIAL INSTRUCTIONS PERTAINING TO HAND-CARRIED OFFERS:

Hand-carried offers must be delivered to: 911 Wilshire Blvd., Public Affairs Office (PAO), Suite 980, Los Angeles, CA 90017.

Due to security precautions, all Corps of Engineers visitors are now required to check in at the Public Affairs Office (PAO), Suite 980, Wilshire Blvd, Los Angeles, CA at which time they will be escorted within the building. Offerors are no longer permitted to hand-carry their offers directly to Contracting Division. **Offers may NOT be either turned-in or left unattended at the Public Affairs Office (PAO), Suite 980.**

The Contract Specialist will be in the Public Affairs Office (PAO), Suite 980, 30 minutes prior to the scheduled closing time/date for receipt of proposals.

Offerors who wish to hand-deliver their offers at an earlier date and time must notify the Contract Specialist in advance in order to arrange to be met at the Public Affairs Office, Suite 980 by Contracting Personnel. In the event the Contract Specialist cannot be reached, please call the main Contracting Division telephone number, 213.452.3231, in order to request assistance.

In order to expedite visitor processing, offerors must complete the information requested on the Notice of Visitor(s) Form that is attached at the end of this clause. The completed form must then be faxed to the Contract Specialist 24 hours prior to the date for receipt of proposals. In addition, no more than 2 visitors per firm will be permitted within the building. No exceptions will be made. Please ensure that all courier and delivery personnel are aware of these special procedures pertaining to hand carried offers.

NOTICE OF VISITOR(S)		
1. Date(s) of Visit (<i>Inclusive</i>)		2. Arrival Time
3. Name of Visitor(s) (<i>Last, First</i>)		4. Agency/Company of Visitor
5. Name of Person Being Visited (<i>Include Div, Br, Sec</i>)	6. Suite Number	7. Telephone Number
8. Contact Person (<i>if other than Person Being Visited</i>)		9. Telephone Number
10. Other Comments or Instructions		
<ul style="list-style-type: none"> - All visitors must report to the Public Affairs Office, Suite 980 - Visitors must use the Visitor Tag provided. - Visitors must be escorted to Corps of Engineers floors - Parking validation is only available for Engineering Division, Construction-Operations, and Information Management field personnel. - Delivery personnel will be validated for 30 minutes only. 		

52.211-2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) AND DESCRIPTIONS LISTED IN THE ACQUISITION MANAGEMENT SYSTEMS AND DATA REQUIREMENTS CONTROL LIST, DOD 5010.12-L (DEC 1999)

Copies of specifications, standards, and data item descriptions cited in this solicitation may be obtained--

(a) From the ASSIST database via the Internet at <http://assist.daps.mil>; or

(b) By submitting a request to the--Department of Defense Single Stock Point (DoDSSP), Building 4, Section D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Telephone (215) 697-2667/2179, Facsimile (215) 697-1462.

(End of provision)

52.214-3 AMENDMENTS TO INVITATIONS FOR BIDS (DEC 1989)

(a) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.

(b) Bidders shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment number and date in the space provided for this purpose on the form for submitting a bid, (3) by letter or telegram, or (4) by facsimile, if facsimile bids are authorized in the solicitation. The Government must receive the acknowledgment by the time and at the place specified for receipt of bids.

(End of provision)

52.214-4 FALSE STATEMENTS IN BIDS (APR 1984)

Bidders must provide full, accurate, and complete information as required by this solicitation and its attachments. The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

(End of provision)

52.214-5 SUBMISSION OF BIDS (MAR 1997)

(a) Bids and bid modifications shall be submitted in sealed envelopes or packages (unless submitted by electronic means) (1) addressed to the office specified in the solicitation, and (2) showing the time and date specified for receipt, the solicitation number, and the name and address of the bidder.

(b) Bidders using commercial carrier services shall ensure that the bid is addressed and marked on the outermost envelope or wrapper as prescribed in subparagraphs (a)(1) and (2) of this provision when delivered to the office specified in the solicitation.

(c) Telegraphic bids will not be considered unless authorized by the solicitation; however, bids may be modified or withdrawn by written or telegraphic notice.

(d) Facsimile bids, modifications, or withdrawals, will not be considered unless authorized by the solicitation.

(e) Bids submitted by electronic commerce shall be considered only if the electronic commerce method was specifically stipulated or permitted by the solicitation.

(End of provision)

52.214-6 EXPLANATION TO PROSPECTIVE BIDDERS (APR 1984)

Any prospective bidder desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing soon enough to allow a reply to reach all prospective bidders before the submission of their bids. Oral explanations or instructions given before the award of a contract will not be binding. Any information given a prospective bidder concerning a solicitation will be furnished promptly to all other prospective bidders as an amendment to the solicitation, if that information is necessary in submitting bids or if the lack of it would be prejudicial to other prospective bidders.

(End of provision)

52.214-7 LATE SUBMISSIONS, MODIFICATIONS, AND WITHDRAWALS OF BIDS (NOV 1999)

(a) Bidders are responsible for submitting bids, and any modifications or withdrawals, so as to reach the Government office designated in the invitation for bids (IFB) by the time specified in the IFB. If no time is specified in the IFB, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that bids are due.

(b)(1) Any bid, modification, or withdrawal received at the Government office designated in the IFB after the exact time specified for receipt of bids is "late" and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late bid would not unduly delay the acquisition; and--

(i) If it was transmitted through an electronic commerce method authorized by the IFB, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of bids; or

(ii) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of bids and was under the Government's control prior to the time set for receipt of bids.

(2) However, a late modification of an otherwise successful bid that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(c) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the bid wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(d) If an emergency or unanticipated event interrupts normal Government processes so that bids cannot be received at the Government office designated for receipt of bids by the exact time specified in the IFB and urgent Government requirements preclude amendment of the IFB, the time specified for receipt of bids will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(e) Bids may be withdrawn by written notice received at any time before the exact time set for receipt of bids. If the IFB authorizes facsimile bids, bids may be withdrawn via facsimile received at any time before the exact time set for receipt of bids, subject to the conditions specified in the provision at 52.214-31, Facsimile Bids. A bid may be withdrawn in person by a bidder or its authorized representative if, before the exact time set for receipt of bids, the identity of the person requesting withdrawal is established and the person signs a receipt for the bid.

(End of provision)

52.214-18 PREPARATION OF BIDS--CONSTRUCTION (APR 1984)

(a) Bids must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing a bid must initial each erasure or change appearing on any bid form.

(b) The bid form may require bidders to submit bid prices for one or more items on various bases, including--

(1) Lump sum bidding;

(2) Alternate prices;

(3) Units of construction; or

(4) Any combination of subparagraphs (1) through (3) above.

(c) If the solicitation requires bidding on all items, failure to do so will disqualify the bid. If bidding on all items is not required, bidders should insert the words "no bid" in the space provided for any item on which no price is submitted.

(d) Alternate bids will not be considered unless this solicitation authorizes their submission.

(End of provision)

52.214-19 CONTRACT AWARD--SEALED BIDDING--CONSTRUCTION (AUG 1996)

(a) The Government will evaluate bids in response to this solicitation without discussions and will award a contract to the responsible bidder whose bid, conforming to the solicitation, will be most advantageous to the Government, considering only price and the price-related factors specified elsewhere in the solicitation.

(b) The Government may reject any or all bids, and waive informalities or minor irregularities in bids received.

(c) The Government may accept any item or combination of items, unless doing so is precluded by a restrictive limitation in the solicitation or the bid.

(d) The Government may reject a bid as nonresponsive if the prices bid are materially unbalanced between line items or subline items. A bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated in relation to cost for other work, and if there is a reasonable doubt that the bid will result in the lowest overall cost to the Government even though it may be the low evaluated bid, or if it is so unbalanced as to be tantamount to allowing an advance payment.

(End of provision)

52.214-34 SUBMISSION OF OFFERS IN THE ENGLISH LANGUAGE (APR 1991)

Offers submitted in response to this solicitation shall be in the English language. Offers received in other than English shall be rejected.

(End of provision)

52.214-35 SUBMISSION OF OFFERS IN U.S. CURRENCY (APR 1991)

Offers submitted in response to this solicitation shall be in terms of U.S. dollars. Offers received in other than U.S. dollars shall be rejected.

(End of provision)

52.216-1 TYPE OF CONTRACT (APR 1984)

The Government contemplates award of a FIRM FIXED PRICE contract resulting from this solicitation.

(End of clause)

52.217-5 EVALUATION OF OPTIONS (JUL 1990)

(a) Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

(b) The Government may reject an offer as nonresponsive if it is materially unbalanced as to prices for the basic requirement and the option quantities. An offer is unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated for other work.

(End of provision)

52.219-18 NOTIFICATION OF COMPETITION LIMITED TO ELIGIBLE 8(A) CONCERNS (JUN 1999)

(a) Offers are solicited only from small business concerns expressly certified by the Small Business Administration (SBA) for participation in the SBA's 8(a) Program and which meet the following criteria at the time of submission of offer--The SBA has determined that, for this procurement, **competition will be restricted to eligible 8(a) contractors serviced by the Santa Ana District Office of the SBA with a NAICS code 236220, among their approved NAICS Codes.**

(1) The Offeror is in conformance with the 8(a) support limitation set forth in its approved business plan; and

(2) The Offeror is in conformance with the Business Activity Targets set forth in its approved business plan or any remedial action directed by the SBA.

(b) By submission of its offer, the Offeror represents that it meets all of the criteria set forth in paragraph (a) of this clause.

(c) Any award resulting from this solicitation will be made to the Small Business Administration, which will subcontract performance to the successful 8(a) offeror selected through the evaluation criteria set forth in this solicitation.

(d)(1) Agreement. A small business concern submitting an offer in its own name agrees to furnish, in performing the contract, only end items manufactured or produced by small business concerns in the United States. The term "United States" includes its territories and possessions, the Commonwealth of Puerto Rico, the Trust Territory of the Pacific Islands, and the District of Columbia. If this procurement is processed under simplified acquisition procedures and the total amount of this contract does not exceed \$25,000, a small business concern may furnish the product of any domestic firm. This paragraph does not apply in connection with construction or service contracts.

(2) The Offeror will notify the Los Angeles District Contracting Officer in writing immediately upon entering an agreement (either oral or written) to transfer all or part of its stock or other ownership interest to any other party.

(End of clause)

52.225-12 NOTICE OF BUY AMERICAN ACT REQUIREMENT-- CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (MAY 2002)

(a) Definitions. Construction material, designated country construction material, domestic construction material, foreign construction material, and NAFTA country construction material, as used in this provision, are defined in the clause of this solicitation entitled "Buy American Act--Construction Materials under Trade Agreements" (Federal Acquisition Regulation (FAR) clause 52.225-11).

(b) Requests for determination of inapplicability. An offeror requesting a determination regarding the inapplicability of the Buy American Act should submit the request to the Contracting Officer in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of FAR clause 52.225-11 in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act or Balance of Payments Program before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

(c) Evaluation of offers. (1) The Government will evaluate an offer requesting exception to the requirements of the Buy American Act, based on claimed unreasonable cost of domestic construction materials, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(4)(i) of FAR clause 52.225-11.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) Alternate offers. (1) When an offer includes foreign construction material, other than designated country or NAFTA country construction material, that is not listed by the Government in this solicitation in paragraph (b)(3) of FAR clause 52.225-11, the offeror also may submit an alternate offer based on use of equivalent domestic, designated country, or NAFTA country construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of FAR clause 52.225-11 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of FAR clause 52.225-11 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic, designated country, or NAFTA country construction material, and the offeror shall be required to furnish such domestic, designated country, or NAFTA country construction material. An offer based on use of the foreign construction material for which an exception was requested--

(i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or

(ii) May be accepted if revised during negotiations.

(End of provision)

52.228-1 BID GUARANTEE (SEP 1996)

- (a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.
- (b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.-
- (c) The amount of the bid guarantee shall be 20 percent (20%) of the bid price or \$3,000,000.00, whichever is less.-
- (d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.-
- (e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

(End of clause)

52.232-38 SUBMISSION OF ELECTRONIC FUNDS TRANSFER INFORMATION WITH OFFER (MAY 1999)

The offeror shall provide, with its offer, the following information that is required to make payment by electronic funds transfer (EFT) under any contract that results from this solicitation. This submission satisfies the requirement to provide EFT information under paragraphs (b)(1) and (j) of the clause at 52.232-34, Payment by Electronic Funds Transfer--Other than Central Contractor Registration.

- (1) The solicitation number (or other procurement identification number).
- (2) The offeror's name and remittance address, as stated in the offer.
- (3) The signature (manual or electronic, as appropriate), title, and telephone number of the offeror's official authorized to provide this information.
- (4) The name, address, and 9-digit Routing Transit Number of the offeror's financial agent.
- (5) The offeror's account number and the type of account (checking, savings, or lockbox).
- (6) If applicable, the Fedwire Transfer System telegraphic abbreviation of the offeror's financial agent.
- (7) If applicable, the offeror shall also provide the name, address, telegraphic abbreviation, and 9-digit Routing Transit Number of the correspondent financial institution receiving the wire transfer payment if the offeror's financial agent is not directly on-line to the Fedwire and, therefore, not the receiver of the wire transfer payment.

(End of provision)

52.233-2 SERVICE OF PROTEST (AUG 1996)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from Mr. Daniel Carrasco, Contracting Officer, Lucia A. Carvajal, Contract Specialist, P.O. Box 532711, Los Angeles, CA 90053-2325.

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of provision)

52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995)

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) Site visits will be: Tuesday, 29 July 2003

Location: LA District Irwin Resident Office 5th and F Street, FT Irwin, CA

Point Of Contact

Name: **Pete Massey**

Telephone: **760-380-4389**

(End of provision)

Section 00600
Representations & Certifications

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CLAUSES INCORPORATED BY FULL TEXT

52.203-2 CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985)

(a) The offeror certifies that --

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to --

(i) Those prices,

(ii) The intention to submit an offer, or

(iii) The methods of factors used to calculate the prices offered:

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory --

(1) Is the person in the offeror's organization responsible for determining the prices offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision _____ (insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization);

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision.

(c) If the offeror deletes or modifies subparagraph (a)(2) of this provision, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of clause)

52.203-11 CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (APR 1991)

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this Certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or

after December 23, 1989,--

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of \$100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision, shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000, for each such failure.

(End of provision)

52.204-3 TAXPAYER IDENTIFICATION (OCT 1998)

(a) Definitions.

“Common parent,” as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

“Taxpayer Identification Number (TIN),” as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) Taxpayer Identification Number (TIN).

___ TIN: _____

___ TIN has been applied for.

___ TIN is not required because:

___ Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

___ Offeror is an agency or instrumentality of a foreign government;

___ Offeror is an agency or instrumentality of the Federal Government.

(e) Type of organization.

___ Sole proprietorship;

___ Partnership;

___ Corporate entity (not tax-exempt);

___ Corporate entity (tax-exempt);

___ Government entity (Federal, State, or local);

___ Foreign government;

___ International organization per 26 CFR 1.6049-4;

___ Other _____

(f) Common parent.

___ Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

___ Name and TIN of common parent:

Name _____

TIN _____

(End of provision)

52.204-6 DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (JUN 99)

(a) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation "DUNS" followed by the DUNS number that identifies the offeror's name and address exactly as stated in the offer.

(b) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one. A DUNS number will be provided immediately by telephone at no charge to the offeror. For information on obtaining a DUNS number, the offeror, if located within the United States, should call Dun and Bradstreet at 1-800-333-0505. The offeror should be prepared to provide the following information:

(1) Company name.

(2) Company address.

- (3) Company telephone number.
- (4) Line of business.
- (5) Chief executive officer/key manager.
- (6) Date the company was started.
- (7) Number of people employed by the company.
- (8) Company affiliation.

(c) Offerors located outside the United States may obtain the location and phone number of the local Dun and Bradstreet Information Services office from the Internet Home Page at <http://www.customerservice@dnb.com>. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at globalinfo@mail.dnb.com.

(End of provision)

52.209-5 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (DEC 2001)

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that--

(i) The Offeror and/or any of its Principals--

(A) Are () are not () presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have () have not (), within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are () are not () presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in subdivision (a)(1)(i)(B) of this provision.

(ii) The Offeror has () has not (), within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER SECTION 1001, TITLE 18, UNITED STATES CODE.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

52.219-1 SMALL BUSINESS PROGRAM REPRESENTATIONS (APR 2002)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is (236220).

(2) The small business size standard is (28,500,000.00).

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) Representations. (1) The offeror represents as part of its offer that it () is, () is not a small business concern.

(2) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, for general statistical purposes, that it () is, () is not a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it () is, () is not a women-owned small business concern.

(4) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it () is, () is not a veteran-owned small business concern.

(5) (Complete only if the offeror represented itself as a veteran-owned small business concern in paragraph (b)(4) of this provision.) The offeror represents as part of its offer that it () is, () is not a service-disabled veteran-owned small business concern.

(6) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, as part of its offer, that--

(i) It () is, () is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration,

and no material change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR part 126; and

(ii) It () is, () is not a joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph (b)(6)(i) of this provision is accurate for the HUBZone small business concern or concerns that are participating in the joint venture. (The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture: _____.) Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

(c) Definitions. As used in this provision--

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern," means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

Veteran-owned small business concern means a small business concern--

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

"Women-owned small business concern," means a small business concern --

(1) That is at least 51 percent owned by one or more women; in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Notice.

(1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small, HUBZone small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded

under the preference programs established pursuant to section 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

- (i) Be punished by imposition of fine, imprisonment, or both;
 - (ii) Be subject to administrative remedies, including suspension and debarment; and
 - (iii) Be ineligible for participation in programs conducted under the authority of the Act.
- (End of provision)

52.219-2 EQUAL LOW BIDS. (OCT 1995)

(a) This provision applies to small business concerns only.

(b) The bidder's status as a labor surplus area (LSA) concern may affect entitlement to award in case of tie bids. If the bidder wishes to be considered for this priority, the bidder must identify, in the following space, the LSA in which the costs to be incurred on account of manufacturing or production (by the bidder or the first-tier subcontractors) amount to more than 50 percent of the contract price.

—

(c) Failure to identify the labor surplus area as specified in paragraph (b) of this provision will preclude the bidder from receiving priority consideration. If the bidder is awarded a contract as a result of receiving priority consideration under this provision and would not have otherwise received award, the bidder shall perform the contract or cause the contract to be performed in accordance with the obligations of an LSA concern.

52.219-19 SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (OCT 2000)

(a) Definition.

"Emerging small business" as used in this solicitation, means a small business concern whose size is no greater than 50 percent of the numerical size standard applicable to the North American Industry Classification System (NAICS) code assigned to a contracting opportunity.

(b) [Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.] The Offeror [] is, [] is not an emerging small business.

(c) (Complete only if the Offeror is a small business or an emerging small business, indicating its size range.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of

annual receipts). (Check one of the following.)

No. of Employees Avg. Annual Gross Revenues

____ 50 or fewer ____ \$1 million or less

____ 51 - 100 ____ \$1,000,001 - \$2 million

____ 101 - 250 ____ \$2,000,001 - \$3.5 million

____ 251 - 500 ____ \$3,500,001 - \$5 million

____ 501 - 750 ____ \$5,000,001 - \$10 million

____ 751 - 1,000 ____ \$10,000,001 - \$17 million

____ Over 1,000 ____ Over \$17 million

(End of provision)

52.222-21 PROHIBITION OF SEGREGATED FACILITIES (FEB 1999)

(a) Segregated facilities, as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(b) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Opportunity clause of this contract.

(End of clause)

52.222-22 PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (FEB 1999)

The offeror represents that --

(a) () It has, () has not participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation;

(b) () It has, () has not, filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

(End of provision)

52.222-38 COMPLIANCE WITH VETERANS' EMPLOYMENT REPORTING REQUIREMENTS
(DEC 2001)

By submission of its offer, the offeror represents that, if it is subject to the reporting requirements of 38 U.S.C. 4212(d) (i.e., if it has any contract containing Federal Acquisition Regulation clause 52.222-37, Employment Reports on Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans), it has submitted the most recent VETS-100 Report required by that clause.

(End of provision)

52.223-13 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (OCT 2000)

(a) Submission of this certification is a prerequisite for making or entering into this contract imposed by Executive Order 12969, August 8, 1995.

(b) By signing this offer, the offeror certifies that--

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facility is exempt for at least one of the following reasons: (Check each block that is applicable.)

() (i) The facility does not manufacture, process or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

() (ii) The facility does not have 10 or more full-time employees as specified in section 313.(b)(1)(A) of EPCRA 42 U.S.C. 11023(b)(1)(A);

() (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

() (iv) The facility does not fall within Standard Industrial Classification Code (SIC) major groups 20 through 39 or their corresponding North American Industry Classification System (NAICS) sectors 31 through 33; or

() (v) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(End of clause)

252.204-7001 COMMERCIAL AND GOVERNMENT ENTITY (CAGE) CODE REPORTING (AUG 1999)

(a) The offeror is requested to enter its CAGE code on its offer in the block with its name and address. The CAGE code entered must be for that name and address. Enter "CAGE" before the number.

(b) If the offeror does not have a CAGE code, it may ask the Contracting Officer to request one from the Defense Logistics Information Service (DLIS). The Contracting Officer will--

(1) Ask the Contractor to complete section B of a DD Form 2051, Request for Assignment of a Commercial and Government Entity (CAGE) Code;

(2) Complete section A and forward the form to DLIS; and

(3) Notify the Contractor of its assigned CAGE code.

(c) Do not delay submission of the offer pending receipt of a CAGE code.

(End of provision)

252.204-7004 REQUIRED CENTRAL CONTRACTOR REGISTRATION (NOV 2001)

(a) Definitions.

As used in this clause--

(1) Central Contractor Registration (CCR) database means the primary DoD repository for contractor information required for the conduct of business with DoD.

(2) Data Universal Numbering System (DUNS) number means the 9-digit number assigned by Dun and Bradstreet Information Services to identify unique business entities.

(3) Data Universal Numbering System +4 (DUNS+4) number means the DUNS number assigned by Dun and Bradstreet plus a 4-digit suffix that may be assigned by a parent (controlling) business concern. This 4-digit suffix may be assigned at the discretion of the parent business concern for such purposes as identifying subunits or affiliates of the parent business concern.

(4) Registered in the CCR database means that all mandatory information, including the DUNS number or the DUNS+4 number, if applicable, and the corresponding Commercial and Government Entity (CAGE) code, is in the CCR database; the DUNS number and the CAGE code have been validated; and all edits have been successfully completed.

(b)(1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee must be registered in the CCR database prior to award, during performance, and through final payment of any contract resulting from this solicitation, except for awards to foreign vendors for work to be performed outside the United States.

(2) The offeror shall provide its DUNS or, if applicable, its DUNS+4 number with its offer, which will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(3) Lack of registration in the CCR database will make an offeror ineligible for award.

(4) DoD has established a goal of registering an applicant in the CCR database within 48 hours after receipt of a complete and accurate application via the Internet. However, registration of an applicant submitting an

application through a method other than the Internet may take up to 30 days. Therefore, offerors that are not registered should consider applying for registration immediately upon receipt of this solicitation.

(c) The Contractor is responsible for the accuracy and completeness of the data within the CCR, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after the initial registration, the Contractor is required to confirm on an annual basis that its information in the CCR database is accurate and complete.

(d) Offerors and contractors may obtain information on registration and annual confirmation requirements by calling 1-888-227-2423, or via the Internet at <http://www.ccr.gov>.

(End of clause)

252.209-7001 DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (MAR 1998)

(a) "Definitions."

As used in this provision --

(a) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405(j)(i)(A)), to be a country the government of which has repeatedly provided support for such acts of international terrorism. As of the date of this provision, terrorist countries include: Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means --

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in "nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtedness of a firm.

(b) "Prohibition on award."

In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary or, in the case of a subsidiary, the firm that owns the subsidiary, unless a waiver is granted by the Secretary of Defense.

(c) "Disclosure."

If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclose such interest in an attachment to its offer. If the Offeror is a

subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include --

- (1) Identification of each government holding a significant interest; and
- (2) A description of the significant interest held by each government.

(End of provision)

252.247-7022 REPRESENTATION OF EXTENT OF TRANSPORTATION BY SEA (AUG 1992)

(a) The Offeror shall indicate by checking the appropriate blank in paragraph (b) of this provision whether transportation of supplies by sea is anticipated under the resultant contract. The term supplies is defined in the Transportation of Supplies by Sea clause of this solicitation.

(b) Representation. The Offeror represents that it:

____ (1) Does anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

____ (2) Does not anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

(c) Any contract resulting from this solicitation will include the Transportation of Supplies by Sea clause. If the Offeror represents that it will not use ocean transportation, the resulting contract will also include the Defense FAR Supplement clause at 252.247-7024, Notification of Transportation of Supplies by Sea.

(End of provision)

Section 00700
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CLAUSES INCORPORATED BY FULL TEXT

52.202-1 DEFINITIONS (DEC 2001)

(a) Agency head or head of the agency means the Secretary (Attorney General, Administrator, Governor, Chairperson, or other chief official, as appropriate) of the agency, unless otherwise indicated, including any deputy or assistant chief official of the executive agency.

(b) Commercial component means any component that is a commercial item.

(c) Commercial item means--

(1) Any item, other than real property, that is of a type customarily used by the general public or by non-governmental entities for purposes other than governmental purposes, and that--

(i) Has been sold, leased, or licensed to the general public; or

(ii) Has been offered for sale, lease, or license to the general public;

(2) Any item that evolved from an item described in paragraph (c)(1) of this clause through advances in technology or performance and that is not yet available in the commercial marketplace, but will be available in the commercial marketplace in time to satisfy the delivery requirements under a Government solicitation;

(3) Any item that would satisfy a criterion expressed in paragraphs (c)(1) or (c)(2) of this clause, but for--

(i) Modifications of a type customarily available in the commercial marketplace; or

(ii) Minor modifications of a type not customarily available in the commercial marketplace made to meet Federal Government requirements. "Minor" modifications means modifications that do not significantly alter the nongovernmental function or essential physical characteristics of an item or component, or change the purpose of a process. Factors to be considered in determining whether a modification is minor include the value and size of the modification and the comparative value and size of the final product. Dollar values and percentages may be used as guideposts, but are not conclusive evidence that a modification is minor;

(4) Any combination of items meeting the requirements of paragraphs (c)(1), (2), (3), or (5) of this clause that are of a type customarily combined and sold in combination to the general public;

(5) Installation services, maintenance services, repair services, training services, and other services if--

(i) Such services are procured for support of an item referred to in paragraph (c)(1), (2), (3), or (4) of this definition, regardless of whether such services are provided by the same source or at the same time as the item; and

(ii) The source of such services provides similar services contemporaneously to the general public under terms and conditions similar to those offered to the Federal Government;

(6) Services of a type offered and sold competitively in substantial quantities in the commercial marketplace based on established catalog or market prices for specific tasks performed under standard commercial terms and conditions. This does not include services that are sold based on hourly rates without an established catalog or market price for a specific service performed. For purposes of these services--

(i) Catalog price means a price included in a catalog, price list, schedule, or other form that is regularly maintained by the manufacturer or vendor, is either published or otherwise available for inspection by customers, and states prices at which sales are currently, or were last, made to a significant number of buyers constituting the general public; and

(ii) Market prices means current prices that are established in the course of ordinary trade between buyers and sellers free to bargain and that can be substantiated through competition or from sources independent of the offerors.

(7) Any item, combination of items, or service referred to in subparagraphs (c)(1) through (c)(6), notwithstanding the fact that the item, combination of items, or service is transferred between or among separate divisions, subsidiaries, or affiliates of a Contractor; or

(8) A nondevelopmental item, if the procuring agency determines the item was developed exclusively at private expense and sold in substantial quantities, on a competitive basis, to multiple State and local Governments.

(d) Component means any item supplied to the Government as part of an end item or of another component, except that for use in 52.225-9, and 52.225-11 see the definitions in 52.225-9(a) and 52.225-11(a).

(e) Contracting Officer means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(f) Nondevelopmental item means--

(1) Any previously developed item of supply used exclusively for governmental purposes by a Federal agency, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement;

(2) Any item described in paragraph (f)(1) of this definition that requires only minor modification or modifications of a type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency; or

(3) Any item of supply being produced that does not meet the requirements of paragraph (f)(1) or (f)(2) solely because the item is not yet in use.

(g) "Contracting Officer" means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(h) Except as otherwise provided in this contract, the term "subcontracts" includes, but is not limited to, purchase orders and changes and modifications to purchase orders under this contract.

(End of clause)

52.203-3 GRATUITIES (APR 1984)

(a) The right of the Contractor to proceed may be terminated by written notice if, after notice and hearing, the agency head or a designee determines that the Contractor, its agent, or another representative--

(1) Offered or gave a gratuity (e.g., an entertainment or gift) to an officer, official, or employee of the Government; and

(2) Intended, by the gratuity, to obtain a contract or favorable treatment under a contract.

(b) The facts supporting this determination may be reviewed by any court having lawful jurisdiction.

(c) If this contract is terminated under paragraph (a) of this clause, the Government is entitled--

(1) To pursue the same remedies as in a breach of the contract; and

(2) In addition to any other damages provided by law, to exemplary damages of not less than 3 nor more than 10 times the cost incurred by the Contractor in giving gratuities to the person concerned, as determined by the agency head or a designee. (This subparagraph (c)(2) is applicable only if this contract uses money appropriated to the Department of Defense.)

(d) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.203-5 COVENANT AGAINST CONTINGENT FEES (APR 1984)

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a contractor and subject to the contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract on any basis other than the merits of the matter.

(End of clause)

52.203-7 ANTI-KICKBACK PROCEDURES. (JUL 1995)

(a) Definitions.

"Kickback," as used in this clause, means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided, directly or indirectly, to any prime Contractor, prime

Contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a subcontract relating to a prime contract.

"Person," as used in this clause, means a corporation, partnership, business association of any kind, trust, joint-stock company, or individual.

"Prime contract," as used in this clause, means a contract or contractual action entered into by the United States for the purpose of obtaining supplies, materials, equipment, or services of any kind.

"Prime Contractor," as used in this clause, means a person who has entered into a prime contract with the United States.

"Prime Contractor employee," as used in this clause, means any officer, partner, employee, or agent of a prime Contractor.

"Subcontract," as used in this clause, means a contract or contractual action entered into by a prime Contractor or subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind under a prime contract.

"Subcontractor," as used in this clause, (1) means any person, other than the prime Contractor, who offers to furnish or furnishes any supplies, materials, equipment, or services of any kind under a prime contract or a subcontract entered into in connection with such prime contract, and (2) includes any person who offers to furnish or furnishes general supplies to the prime Contractor or a higher tier subcontractor.

"Subcontractor employee," as used in this clause, means any officer, partner, employee, or agent of a subcontractor.

(b) The Anti-Kickback Act of 1986 (41 U.S.C. 51-58) (the Act), prohibits any person from -

(1) Providing or attempting to provide or offering to provide any kickback;

(2) Soliciting, accepting, or attempting to accept any kickback; or

(3) Including, directly or indirectly, the amount of any kickback in the contract price charged by a prime Contractor to the United States or in the contract price charged by a subcontractor to a prime Contractor or higher tier subcontractor.

(c)(1) The Contractor shall have in place and follow reasonable procedures designed to prevent and detect possible violations described in paragraph (b) of this clause in its own operations and direct business relationships.

(2) When the Contractor has reasonable grounds to believe that a violation described in paragraph (b) of this clause may have occurred, the Contractor shall promptly report in writing the possible violation. Such reports shall be made to the inspector general of the contracting agency, the head of the contracting agency if the agency does not have an inspector general, or the Department of Justice.

(3) The Contractor shall cooperate fully with any Federal agency investigating a possible violation described in paragraph (b) of this clause.

(4) The Contracting Officer may (i) offset the amount of the kickback against any monies owed by the United States under the prime contract and/or (ii) direct that the Prime Contractor withhold, from sums owed a subcontractor under the prime contract, the amount of any kickback. The Contracting Officer may order the monies withheld under subdivision (c)(4)(ii) of this clause be paid over to the Government unless the Government has already offset those monies under subdivision (c)(4)(i) of this clause. In either case, the Prime Contractor shall notify the Contracting Officer when the monies are withheld.

(5) The Contractor agrees to incorporate the substance of this clause, including this subparagraph (c)(5) but excepting subparagraph (c)(1), in all subcontracts under this contract which exceed \$100,000.

52.203-8 CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)

(a) If the Government receives information that a contractor or a person has engaged in conduct constituting a violation of subsection (a), (b), (c), or (d) of Section 27 of the Office of Federal Procurement Policy Act (41 U.S.C. 423) (the Act), as amended by section 4304 of the 1996 National Defense Authorization Act for Fiscal Year 1996 (Pub. L. 104-106), the Government may--

(1) Cancel the solicitation, if the contract has not yet been awarded or issued; or

(2) Rescind the contract with respect to which--

(i) The Contractor or someone acting for the Contractor has been convicted for an offense where the conduct constitutes a violation of subsection 27(a) or (b) of the Act for the purpose of either--

(A) Exchanging the information covered by such subsections for anything of value; or

(B) Obtaining or giving anyone a competitive advantage in the award of a Federal agency procurement contract; or

(ii) The head of the contracting activity has determined, based upon a preponderance of the evidence, that the Contractor or someone acting for the Contractor has engaged in conduct constituting an offense punishable under subsections 27(e)(1) of the Act.

(b) If the Government rescinds the contract under paragraph (a) of this clause, the Government is entitled to recover, in addition to any penalty prescribed by law, the amount expended under the contract.

(c) The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law, regulation, or under this contract.

(End of clause)

52.203-10 PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)

(a) The Government, at its election, may reduce the price of a fixed-price type contract and the total cost and fee under a cost-type contract by the amount of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or designee determines that there was a violation of subsection 27 (a), (b), or (c) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in section 3.104 of the Federal Acquisition Regulation.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be--

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award, notwithstanding any minimum fee or "fee floor" specified in the contract;

(3) For cost-plus-award-fee contracts--

- (i) The base fee established in the contract at the time of contract award;
- (ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may--

- (i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or
- (ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract. The total final price established in accordance with the incentive price revision provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed-price contracts, by 10 percent of the initial contract price or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.

(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.203-12 LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (JUN 1997)

(a) Definitions.

"Agency," as used in this clause, means executive agency as defined in 2.101.

"Covered Federal action," as used in this clause, means any of the following Federal actions:

- (1) The awarding of any Federal contract.
- (2) The making of any Federal grant.
- (3) The making of any Federal loan.
- (4) The entering into of any cooperative agreement.
- (5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

(1) An individual who is appointed to a position in the Government under Title 5, United States Code, including a position under a temporary appointment.

(2) A member of the uniformed services, as defined in subsection 101(3), Title 37, United States Code.

(3) A special Government employee, as defined in section 202, Title 18, United States Code.

(4) An individual who is a member of a Federal advisory committee, as defined by the Federal Advisory Committee Act, Title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual, corporation, company, association, authority, firm, partnership, society, State, and local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means, with respect to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Regularly employed," as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

"State," as used in this clause, means a State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, a territory or possession of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) Prohibitions.

(1) Section 1352 of Title 31, United States Code, among other things, prohibits a recipient of a Federal contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) Agency and legislative liaison by own employees.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b)(3)(i)(A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person's products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person's products or services for an agency's use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action--

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b)(3)(i)(A) of this clause are permitted under this clause.

(ii) Professional and technical services.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of--

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

(2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.

(B) For purposes of subdivision (b)(3)(ii)(A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance or operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis is rendered directly and solely in the preparation, submission or negotiation of a covered Federal action. Thus, for example, communications with the intent to influence made by a lawyer that do not provide legal advice or analysis directly and solely related to the legal aspects of his or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.

(C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.

(D) Only those services expressly authorized by subdivisions (b)(3)(ii)(A)(1) and (2) of this clause are permitted under this clause.

(E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(c) Disclosure.

(1) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b)(1) of this clause, if paid for with appropriated funds.

(2) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c)(1) of this clause. An event that materially affects the accuracy of the information reported includes--

(i) A cumulative increase of \$25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or

(ii) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(iii) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

(3) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or receives any subcontract exceeding \$100,000 under the Federal contract.

(4) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontract file of the awarding Contractor.

(d) Agreement. The Contractor agrees not to make any payment prohibited by this clause.

(e) Penalties.

(1) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(2) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(f) Cost allowability. Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely, costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

(End of clause)

52.204-1 APPROVAL OF CONTRACT (DEC 1989)

This contract is subject to the written approval of **Lucia Carvajal Contracting Officer** and shall not be binding until so approved.

(End of clause)

52.204-4 PRINTED OR COPIED DOUBLE-SIDED ON RECYCLED PAPER (AUG 2000)

(a) Definitions. As used in this clause--

“Postconsumer material” means a material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item. Postconsumer material is a part of the broader category of “recovered material.” For paper and paper products, postconsumer material means “postconsumer fiber” defined by the U.S. Environmental Protection Agency (EPA) as--

- (1) Paper, paperboard, and fibrous materials from retail stores, office buildings, homes, and so forth, after they have passed through their end-usage as a consumer item, including: used corrugated boxes; old newspapers; old magazines; mixed waste paper; tabulating cards; and used cordage; or
- (2) All paper, paperboard, and fibrous materials that enter and are collected from municipal solid waste; but not
- (3) Fiber derived from printers' over-runs, converters' scrap, and over-issue publications.

"Printed or copied double-sided" means printing or reproducing a document so that information is on both sides of a sheet of paper.

"Recovered material," for paper and paper products, is defined by EPA in its Comprehensive Procurement Guideline as "recovered fiber" and means the following materials:

- (1) Postconsumer fiber; and
- (2) Manufacturing wastes such as--
 - (i) Dry paper and paperboard waste generated after completion of the papermaking process (that is, those manufacturing operations up to and including the cutting and trimming of the paper machine reel into smaller rolls or rough sheets) including: envelope cuttings, bindery trimmings, and other paper and paperboard waste resulting from printing, cutting, forming, and other converting operations; bag, box, and carton manufacturing wastes; and butt rolls, mill wrappers, and rejected unused stock; and
 - (ii) Repulped finished paper and paperboard from obsolete inventories of paper and paperboard manufacturers, merchants, wholesalers, dealers, printers, converters, or others.
- (b) In accordance with Section 101 of Executive Order 13101 of September 14, 1998, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition, the Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed or copied double-sided on recycled paper that meet minimum content standards specified in Section 505 of Executive Order 13101, when not using electronic commerce methods to submit information or data to the Government.
- (c) If the Contractor cannot purchase high-speed copier paper, offset paper, forms bond, computer printout paper, carbonless paper, file folders, white wove envelopes, writing and office paper, book paper, cotton fiber paper, and cover stock meeting the 30 percent postconsumer material standard for use in submitting paper documents to the Government, it should use paper containing no less than 20 percent postconsumer material. This lesser standard should be used only when paper meeting the 30 percent postconsumer material standard is not obtainable at a reasonable price or does not meet reasonable performance standards.

(End of clause)

52.209-6 Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment (JUL 1995)

- (a) The Government suspends or debar Contractors to protect the Government's interests. The Contractor shall not enter into any subcontract in excess of the \$25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.
- (b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed \$25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principles, is or is not debarred, suspended, or proposed for debarment by the Federal

Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs). The notice must include the following:

- (1) The name of the subcontractor.
- (2) The Contractor's knowledge of the reasons for the subcontractor being on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.
- (3) The compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.
- (4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interests when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

(End of clause)

52.214-26 Audit and Records--Sealed Bidding. (OCT 1997)

(a) As used in this clause, records includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) Cost or pricing data. If the Contractor has been required to submit cost or pricing data in connection with the pricing of any modification to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections, related to--

- (1) The proposal for the modification;
- (2) The discussions conducted on the proposal(s), including those related to negotiating;
- (3) Pricing of the modification; or
- (4) Performance of the modification.

(c) Comptroller General. In the case of pricing any modification, the Comptroller General of the United States, or an authorized representative, shall have the same rights as specified in paragraph (b) of this clause.

(d) Availability. The Contractor shall make available at its office at all reasonable times the materials described in reproduction, until 3 years after final payment under this contract, or for any other period specified in Subpart 4.7 of the Federal Acquisition Regulation (FAR). FAR Subpart 4.7, Contractor Records Retention, in effect on the date of this contract, is incorporated by reference in its entirety and made a part of this contract.

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement.

(2) Records pertaining to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to the performance of this contract shall be made available until disposition of such appeals, litigation, or claims.

(e) The Contractor shall insert a clause containing all the provisions of this clause, including this paragraph (e), in all subcontracts expected to exceed the threshold in FAR 15.403-4(a)(1) for submission of cost or pricing data.

(End of clause)

52.214-27 Price Reduction for Defective Cost or Pricing Data - Modifications - Sealed Bidding. (OCT 1997)

(a) This clause shall become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for the submission of cost or pricing data at FAR 15.403-4(a)(1), except that this clause does not apply to a modification if an exception under FAR 15.403-1(b) applies.

(1) Based on adequate price competition;

(2) Based on established catalog or market prices of commercial items sold in substantial quantities to the general public; or

(3) Set by law or regulation.

(b) If any price, including profit, negotiated in connection with any modification under this clause, was increased by any significant amount because

(1) the Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data;

(2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data; or

(3) any of these parties furnished data of any description that were not accurate, the price shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) above.

(c) Any reduction in the contract price under paragraph (b) above due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which:

(1) the actual subcontract; or

(2) the actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(d) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made:

(1) the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted;

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer;

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract; or

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2) Except as prohibited by subdivision (d)(2)(ii) of this clause:

(i) an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if:

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the date of agreement on the price of the contract (or price of the modification) and that the data were not submitted before such date.

(ii) An offset shall not be allowed if:

(A) The understated data was known by the Contractor to be understated when the Certificate of Current Cost or Pricing Data was signed; or (B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data had been submitted before the date of agreement on price.

(e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid:

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and

(2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

(End of clause)

52.214-28 Subcontractor Cost or Pricing Data - Modifications - Sealed Bidding. (OCT 1997)

(a) The requirements of paragraphs (b) and (c) of this clause shall:

(1) become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at (FAR) 48 CFR 15.403-4(a)(1); and

(2) be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modifications involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.403-1(b) applies.

(1) Based on adequate price competition;

(2) Based on established catalog or market prices of commercial items sold in substantial quantities to the general public; or

(3) Set by law or regulation.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in subsection 15.406-2 of the Federal Acquisition Regulation that, to the best of its knowledge and belief, the data submitted under paragraph (b) above were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(d) The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that, when entered into, exceeds the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1).

(End of clause)

52.215-19 NOTIFICATION OF OWNERSHIP CHANGES (OCT 1997)

(a) The Contractor shall make the following notifications in writing:

(1) When the Contractor becomes aware that a change in its ownership has occurred, or is certain to occur, that could result in changes in the valuation of its capitalized assets in the accounting records, the Contractor shall notify the Administrative Contracting Officer (ACO) within 30 days.

(2) The Contractor shall also notify the ACO within 30 days whenever changes to asset valuations or any other cost changes have occurred or are certain to occur as a result of a change in ownership.

(b) The Contractor shall--

(1) Maintain current, accurate, and complete inventory records of assets and their costs;

(2) Provide the ACO or designated representative ready access to the records upon request;

(3) Ensure that all individual and grouped assets, their capitalized values, accumulated depreciation or amortization, and remaining useful lives are identified accurately before and after each of the Contractor's ownership changes; and

(4) Retain and continue to maintain depreciation and amortization schedules based on the asset records maintained before each Contractor ownership change.

The Contractor shall include the substance of this clause in all subcontracts under this contract that meet the applicability requirement of FAR 15.408(k).

(End of clause)

52.219-8 UTILIZATION OF SMALL BUSINESS CONCERNS (OCT 2000)

(a) It is the policy of the United States that small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns shall have the maximum practicable opportunity to participate in performing contracts let by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its prime contractors establish procedures to ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns.

(b) The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. The Contractor further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of the Contractor's compliance with this clause.

Definitions. As used in this contract--

HUBZone small business concern means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

Small business concern means a small business as defined pursuant to Section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto.

Small disadvantaged business concern means a small business concern that represents, as part of its offer that--

(1) It has received certification as a small disadvantaged business concern consistent with 13 CFR part 124, subpart B;

(2) No material change in disadvantaged ownership and control has occurred since its certification;

(3) Where the concern is owned by one or more individuals, the net worth of each individual upon whom the certification is based does not exceed \$750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); and

(4) It is identified, on the date of its representation, as a certified small disadvantaged business in the database maintained by the Small Business Administration (PRO-Net).

Veteran-owned small business concern means a small business concern--

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

Women-owned small business concern means a small business concern--

(1) That is at least 51 percent owned by one or more women, or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern, a veteran-owned small business concern, a service-disabled veteran-owned small business concern, a HUBZone small business concern, a small disadvantaged business concern, or a women-owned small business concern.

(End of clause)

52.219-14 LIMITATIONS ON SUBCONTRACTING (DEC 1996)

(a) This clause does not apply to the unrestricted portion of a partial set-aside.

(b) By submission of an offer and execution of a contract, the Offeror/Contractor agrees that in performance of the contract in the case of a contract for--

(1) Services (except construction). At least 50 percent of the cost of contract performance incurred for personnel shall be expended for employees of the concern.

(2) Supplies (other than procurement from a nonmanufacturer of such supplies). The concern shall perform work for at least 50 percent of the cost of manufacturing the supplies, not including the cost of materials.

(3) General construction. The concern will perform at least 15 percent of the cost of the contract, not including the cost of materials, with its own employees.

(4) Construction by special trade contractors. The concern will perform at least 25 percent of the cost of the contract, not including the cost of materials, with its own employees.

52.219-25 SMALL DISADVANTAGED BUSINESS PARTICIPATION PROGRAM— DISADVANTAGED STATUS AND REPORTING (OCT 1999)

(a) Disadvantaged status for joint venture partners, team members, and subcontractors. This clause addresses disadvantaged status for joint venture partners, teaming arrangement members, and subcontractors and is applicable if this contract contains small disadvantaged business (SDB) participation targets. The Contractor shall obtain representations of small disadvantaged status from joint venture partners, teaming arrangement members, and subcontractors through use of a provision substantially the same as paragraph (b)(1)(i) of the provision at FAR 52.219-22, Small Disadvantaged Business Status. The Contractor shall confirm that a joint venture partner, team member, or subcontractor representing itself as a

small disadvantaged business concern, is identified as a certified small disadvantaged business in the database maintained by the Small Business Administration (PRO-Net) or by contacting the SBA's Office of Small Disadvantaged Business Certification and Eligibility.

(b) Reporting requirement. If this contract contains SDB participation targets, the Contractor shall report on the participation of SDB concerns at contract completion, or as otherwise provided in this contract. Reporting may be on Optional Form 312, Small Disadvantaged Business Participation Report, or in the Contractor's own format providing the same information. This report is required for each contract containing SDB participation targets. If this contract contains an individual Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, reports may be submitted with the final Subcontracting Report for Individual Contracts (Standard Form 294) at the completion of the contract.

(End of clause)

52.222-3 Convict Labor (Aug 1996)

The Contractor agrees not to employ in the performance of this contract any person undergoing a sentence of imprisonment which has been imposed by any court of a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands. This limitation, however, shall not prohibit the employment by the Contractor in the performance of this contract of persons on parole or probation to work at paid employment during the term of their sentence or persons who have been pardoned or who have served their terms. Nor shall it prohibit the employment by the Contractor in the performance of this contract of persons confined for violation of the laws of any of the States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands who are authorized to work at paid employment in the community under the laws of such jurisdiction, if--

- (a)(1) The worker is paid or is in an approved work training program on a voluntary basis;
 - (2) Representatives of local union central bodies or similar labor union organizations have been consulted;
 - (3) Such paid employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services; and
 - (4) The rates of pay and other conditions of employment will not be less than those paid or provided for work of a similar nature in the locality in which the work is being performed; and
- (b) The Attorney General of the United States has certified that the work-release laws or regulations of the jurisdiction involved are in conformity with the requirements of Executive Order 11755, as amended by Executive Orders 12608 and 12943.

(End of clause)

52.222-4 Contract Work Hours and Safety Standards Act - Overtime Compensation. (SEP 2000)

(a) Overtime requirements. No Contractor or subcontractor employing laborers or mechanics (see Federal Acquisition Regulation 22.300) shall require or permit them to work over 40 hours in any workweek unless they are paid at least 1 and 1/2 times the basic rate of pay for each hour worked over 40 hours.

(b) Violation; liability for unpaid wages; liquidated damages. The responsible Contractor and subcontractor are liable for unpaid wages if they violate the terms in paragraph (a) of this clause. In addition, the Contractor and subcontractor are liable for liquidated damages payable to the Government. The Contracting

Officer will assess liquidated damages at the rate of \$10 per affected employee for each calendar day on which the employer required or permitted the employee to work in excess of the standard workweek of 40 hours without paying overtime wages required by the Contract Work Hours and Safety Standards Act.

(c) Withholding for unpaid wages and liquidated damages. The Contracting Officer will withhold from payments due under the contract sufficient funds required to satisfy any Contractor or subcontractor liabilities for unpaid wages and liquidated damages. If amounts withheld under the contract are insufficient to satisfy Contractor or subcontractor liabilities, the Contracting Officer will withhold payments from other Federal or Federally assisted contracts held by the same Contractor that are subject to the Contract Work Hours and Safety Standards Act.

(d) Payrolls and basic records.

(1) The Contractor and its subcontractors shall maintain payrolls and basic payroll records for all laborers and mechanics working on the contract during the contract and shall make them available to the Government until 3 years after contract completion. The records shall contain the name and address of each employee, social security number, labor classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. The records need not duplicate those required for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act.

(2) The Contractor and its subcontractors shall allow authorized representatives of the Contracting Officer or the Department of Labor to inspect, copy, or transcribe records maintained under paragraph (d)(1) of this clause. The Contractor or subcontractor also shall allow authorized representatives of the Contracting Officer or Department of Labor to interview employees in the workplace during working hours.

(e) Subcontracts. The Contractor shall insert the provisions set forth in paragraphs (a) through (d) of this clause in subcontracts exceeding \$100,000 and require subcontractors to include these provisions in any lower tier subcontracts. The Contractor shall be responsible for compliance by any subcontractor or lower-tier subcontractor with the provisions set forth in paragraphs (a) through (d) of this clause.

(End of clause)

52.222-6 DAVIS-BACON ACT (FEB 1995)

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination

(including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b)(1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approve an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(c) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(End of clause)

52.222-7 WITHHOLDING OF FUNDS (FEB 1988)

The Contracting Officer shall, upon his or her own action or upon written request of an authorized

representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(End of clause)

52.222-8 PAYROLLS AND BASIC RECORDS (FEB 1988)

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify--

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(End of clause)

52.222-9 APPRENTICES AND TRAINEES (FEB 1988)

(a) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S.

Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(End of clause)

52.222-10 COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988)

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(End of clause)

52.222-11 SUBCONTRACTS (LABOR STANDARDS (FEB 1988)

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act-Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination-Debarment, Disputes Concerning Labor Standards, Compliance with Davis-Bacon and Related Act Regulations, and Certification of Eligibility, and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b)(1) Within 14 days after award of the contract, the Contractor shall deliver to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(2) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall deliver to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

(End of clause)

52.222-12 CONTRACT TERMINATION--DEBARMENT (FEB 1988)

A breach of the contract clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

(End of clause)

52.222-13 COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988)

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this contract.

(End of clause)

52.222-14 DISPUTES CONCERNING LABOR STANDARDS (FEB 1988)

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(End of clause)

52.222-15 CERTIFICATION OF ELIGIBILITY (FEB 1988)

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(End of clause)

52.222-26 EQUAL OPPORTUNITY (APR 2002)

(a) Definition. United States, as used in this clause, means the 50 States, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, the U.S. Virgin Islands, and Wake Island.

(b) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of \$10,000, the Contractor shall comply with paragraphs (b)(1) through (b)(11) of this clause, except for work performed outside the United States by employees who were not recruited within the United States. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. However, it shall not be a violation of this clause for the Contractor to extend a publicly announced preference in employment to Indians living on or near an Indian reservation, in connection with employment opportunities on or near an Indian reservation, as permitted by 41 CFR 60-1.5.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (i) employment, (ii) upgrading, (iii) demotion, (iv) transfer, (v) recruitment or recruitment advertising, (vi) layoff or termination, (vii) rates of pay or other forms of compensation, and (viii) selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. The Contractor shall also file Standard Form 100 (EEO-1), or any successor form, as prescribed in 41 CFR part 60-1. Unless the Contractor has filed within the 12 months preceding the date of contract award, the Contractor shall, within 30 days after contract award, apply to either the regional Office of Federal Contract Compliance Programs (OFCCP) or the local office of the Equal Employment Opportunity Commission for the necessary forms.

(8) The Contractor shall permit access to its premises, during normal business hours, by the contracting agency or the OFCCP for the purpose of conducting on-site compliance evaluations and complaint investigations. The Contractor shall permit the Government to inspect and copy any books, accounts, records (including computerized records), and other material that may be relevant to the matter under investigation and pertinent to compliance with Executive Order 11246, as amended, and rules and regulations that implement the Executive Order.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended; in the rules, regulations, and orders of the Secretary of Labor; or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of subparagraphs (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the contracting officer may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR 60-1.1.

(End of clause)

52.222-27 AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION
(FEB 1999)

(a) Definitions. "Covered area," as used in this clause, means the geographical area described in the solicitation for this contract.

"Deputy Assistant Secretary," as used in this clause, means Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, or a designee.

"Employer's identification number," as used in this clause, means the Federal Social Security number used on the employer's quarterly federal tax return, U.S. Treasury Department Form 941.

"Minority," as used in this clause, means--

(1) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands);

(3) Black (all persons having origins in any of the black African racial groups not of Hispanic origin); and

(4) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race).

(b) If the Contractor, or a subcontractor at any tier, subcontracts a portion of the work involving any construction trade, each such subcontract in excess of \$10,000 shall include this clause and the Notice containing the goals for minority and female participation stated in the solicitation for this contract.

(c) If the Contractor is participating in a Hometown Plan (41 CFR 60-4) approved by the U.S. Department of Labor in a covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals) shall comply with the plan for those trades that have unions participating in the plan. Contractors must be able to demonstrate participation in, and compliance with, the provisions of the plan. Each Contractor or subcontractor participating in an approved plan is also required to comply with its obligations under the Equal Opportunity clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good-faith performance by other Contractors or subcontractors toward a goal in an approved plan does not excuse any Contractor's or subcontractor's failure to make good-faith efforts to achieve the plan's goals.

(d) The Contractor shall implement the affirmative action procedures in subparagraphs (g)(1) through (16) of this clause. The goals stated in the solicitation for this contract are expressed as percentages of the total hours of employment and training of minority and female utilization that the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. If the

Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where that work is actually performed. The Contractor is expected to make substantially uniform progress toward its goals in each craft.

(e) Neither the terms and conditions of any collective bargaining agreement, nor the failure by a union with which the Contractor has a collective bargaining agreement, to refer minorities or women shall excuse the Contractor's obligations under this clause, Executive Order 11246, as amended, or the regulations thereunder.

(f) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(g) The Contractor shall take affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with this clause shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and implement affirmative action steps at least as extensive as the following:

(1) Ensure a working environment free of harassment, intimidation, and coercion at all sites and in all facilities where the Contractor's employees are assigned to work. The Contractor, if possible, will assign two or more women to each construction project. The Contractor shall ensure that foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at these sites or facilities.

(2) Establish and maintain a current list of sources for minority and female recruitment. Provide written notification to minority and female recruitment sources and community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

(3) Establish and maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant, referrals of minorities or females from unions, recruitment sources, or community organizations, and the action taken with respect to each individual. If an individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred back, not employed by the Contractor, this shall be documented in the file, along with whatever additional actions the Contractor may have taken.

(4) Immediately notify the Deputy Assistant Secretary when the union or unions with which the Contractor has a collective bargaining agreement has not referred back to the Contractor a minority or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(5) Develop on-the-job training opportunities and/or participate in training programs for the area that expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under subparagraph (g)(2) of this clause.

(6) Disseminate the Contractor's equal employment policy by--

(i) Providing notice of the policy to unions and to training, recruitment, and outreach programs, and requesting their cooperation in assisting the Contractor in meeting its contract obligations;

- (ii) Including the policy in any policy manual and in collective bargaining agreements;
 - (iii) Publicizing the policy in the company newspaper, annual report, etc.;
 - (iv) Reviewing the policy with all management personnel and with all minority and female employees at least once a year; and
 - (v) Posting the policy on bulletin boards accessible to employees at each location where construction work is performed.
- (7) Review, at least annually, the Contractor's equal employment policy and affirmative action obligations with all employees having responsibility for hiring, assignment, layoff, termination, or other employment decisions. Conduct review of this policy with all on-site supervisory personnel before initiating construction work at a job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
- (8) Disseminate the Contractor's equal employment policy externally by including it in any advertising in the news media, specifically including minority and female news media. Provide written notification to, and discuss this policy with, other Contractors and subcontractors with which the Contractor does or anticipates doing business.
- (9) Direct recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month before the date for acceptance of applications for apprenticeship or training by any recruitment source, send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
- (10) Encourage present minority and female employees to recruit minority persons and women. Where reasonable, provide after-school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.
- (11) Validate all tests and other selection requirements where required under 41 CFR 60-3.
- (12) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for, through appropriate training, etc., opportunities for promotion.
- (13) Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the Contractor's obligations under this contract are being carried out.
- (14) Ensure that all facilities and company activities are nonsegregated except that separate or single-user rest rooms and necessary dressing or sleeping areas shall be provided to assure privacy between the sexes.
- (15) Maintain a record of solicitations for subcontracts for minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
- (16) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's equal employment policy and affirmative action obligations.
- (h) The Contractor is encouraged to participate in voluntary associations that may assist in fulfilling one or more of the affirmative action obligations contained in subparagraphs (g)(1) through (16) of this clause. The efforts of a contractor association, joint contractor-union, contractor-community, or similar group of which the contractor is a member and participant may be asserted as fulfilling one or more of its obligations

under subparagraphs (g)(1) through (16) of this clause, provided the Contractor--

- (1) Actively participates in the group;
- (2) Makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry;
- (3) Ensures that concrete benefits of the program are reflected in the Contractor's minority and female workforce participation;
- (4) Makes a good-faith effort to meet its individual goals and timetables; and
- (5) Can provide access to documentation that demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply is the Contractor's, and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.
 - (i) A single goal for minorities and a separate single goal for women shall be established. The Contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of Executive Order 11246, as amended, if a particular group is employed in a substantially disparate manner.
 - (j) The Contractor shall not use goals or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.
 - (k) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts under Executive Order 11246, as amended.
 - (l) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the Equal Opportunity clause, including suspension, termination, and cancellation of existing subcontracts, as may be imposed or ordered under Executive Order 11246, as amended, and its implementing regulations, by the OFCCP. Any failure to carry out these sanctions and penalties as ordered shall be a violation of this clause and Executive Order 11246, as amended.
 - (m) The Contractor in fulfilling its obligations under this clause shall implement affirmative action procedures at least as extensive as those prescribed in paragraph (g) of this clause, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of Executive Order 11246, as amended, the implementing regulations, or this clause, the Deputy Assistant Secretary shall take action as prescribed in 41 CFR 60-4.8.
 - (n) The Contractor shall designate a responsible official to--
 - (1) Monitor all employment-related activity to ensure that the Contractor's equal employment policy is being carried out;
 - (2) Submit reports as may be required by the Government; and
 - (3) Keep records that shall at least include for each employee the name, address, telephone number, construction trade, union affiliation (if any), employee identification number, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, separate records are not required to be maintained.

Nothing contained herein shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the requirements for the hiring of local or other area residents

(e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

(End of clause)

52.222-36 AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES (JUN 1998)

(a) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against any employee or applicant because of physical or mental disability. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified individuals with disabilities without discrimination based upon their physical or mental disability in all employment practices such as--

(i) Recruitment, advertising, and job application procedures;

(ii) Hiring, upgrading, promotion, award of tenure, demotion, transfer, layoff, termination, right of return from layoff, and rehiring;

(iii) Rates of pay or any other form of compensation and changes in compensation;

(iv) Job assignments, job classifications, organizational structures, position descriptions, lines of progression, and seniority lists;

(v) Leaves of absence, sick leave, or any other leave;

(vi) Fringe benefits available by virtue of employment, whether or not administered by the Contractor;

(vii) Selection and financial support for training, including apprenticeships, professional meetings, conferences, and other related activities, and selection for leaves of absence to pursue training;

(viii) Activities sponsored by the Contractor, including social or recreational programs; and

(ix) Any other term, condition, or privilege of employment.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Rehabilitation Act of 1973 (29 U.S.C. 793) (the Act), as amended.

(b) Postings. (1) The Contractor agrees to post employment notices stating--

(i) The Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified individuals with disabilities; and

(ii) The rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. The Contractor shall ensure that applicants and employees with disabilities are informed of the contents of the notice (e.g., the Contractor may have the notice read to a visually disabled individual, or may lower the posted notice so that it might be read by a person in a wheelchair). The notices shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance of the U.S. Department of Labor (Deputy Assistant Secretary) and shall be provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section

503 of the Act and is committed to take affirmative action to employ, and advance in employment, qualified individuals with physical or mental disabilities.

(c) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(d) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of \$10,000 unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

(End of clause)

52.222-37 EMPLOYMENT REPORTS ON DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA (JAN 1999)

(a) Unless the Contractor is a State or local government agency, the Contractor shall report at least annually, as required by the Secretary of Labor, on--

(1) The number of disabled veterans and the number of veterans of the Vietnam era in the workforce of the contractor by job category and hiring location; and

(2) The total number of new employees hired during the period covered by the report, and of that total, the number of disabled veterans, and the number of veterans of the Vietnam era.

(b) The above items shall be reported by completing the form entitled "Federal Contractor Veterans' Employment Report VETS-100."

(c) Reports shall be submitted no later than September 30 of each year beginning September 30, 1988.

(d) The employment activity report required by paragraph (a)(2) of this clause shall reflect total hires during the most recent 12-month period as of the ending date selected for the employment profile report required by paragraph (a)(1) of this clause. Contractors may select an ending date: (1) As of the end of any pay period during the period January through March 1st of the year the report is due, or (2) as of December 31, if the contractor has previous written approval from the Equal Employment Opportunity Commission to do so for purposes of submitting the Employer Information Report EEO-1 (Standard Form 100).

(e) The count of veterans reported according to paragraph (a) of this clause shall be based on voluntary disclosure. Each Contractor subject to the reporting requirements at 38 U.S.C. 4212 shall invite all disabled veterans and veterans of the Vietnam era who wish to benefit under the affirmative action program at 38 U.S.C. 4212 to identify themselves to the Contractor. The invitation shall state that the information is voluntarily provided; that the information will be kept confidential; that disclosure or refusal to provide the information will not subject the applicant or employee to any adverse treatment; and that the information will be used only in accordance with the regulations promulgated under 38 U.S.C. 4212.

(f) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary.

(End of clause)

52.223-3 HAZARDOUS MATERIAL IDENTIFICATION AND MATERIAL SAFETY DATA (JAN 1997)

(a) "Hazardous material", as used in this clause, includes any material defined as hazardous under the latest version of Federal Standard No. 313 (including revisions adopted during the term of the contract).

(b) The offeror must list any hazardous material, as defined in paragraph (a) of this clause, to be delivered under this contract. The hazardous material shall be properly identified and include any applicable identification number, such as National Stock Number or Special Item Number. This information shall also be included on the Material Safety Data Sheet submitted under this contract.

Material (If none, insert "None")	Identification No.
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(c) This list must be updated during performance of the contract whenever the Contractor determines that any other material to be delivered under this contract is hazardous.

(d) The apparently successful offeror agrees to submit, for each item as required prior to award, a Material Safety Data Sheet, meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous material identified in paragraph (b) of this clause. Data shall be submitted in accordance with Federal Standard No. 313, whether or not the apparently successful offeror is the actual manufacturer of these items. Failure to submit the Material Safety Data Sheet prior to award may result in the apparently successful offeror being considered nonresponsible and ineligible for award.

(e) If, after award, there is a change in the composition of the item(s) or a revision to Federal Standard No. 313, which renders incomplete or inaccurate the data submitted under paragraph (d) of this clause, the Contractor shall promptly notify the Contracting Officer and resubmit the data.

(f) Neither the requirements of this clause nor any act or failure to act by the Government shall relieve the Contractor of any responsibility or liability for the safety of Government, Contractor, or subcontractor personnel or property.

(g) Nothing contained in this clause shall relieve the Contractor from complying with applicable Federal, State, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.

(h) The Government's rights in data furnished under this contract with respect to hazardous material are as follows:

(1) To use, duplicate and disclose any data to which this clause is applicable. The purposes of this right are to--

(i) Apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials;

(ii) Obtain medical treatment for those affected by the material; and

(iii) Have others use, duplicate, and disclose the data for the Government for these purposes.

(2) To use, duplicate, and disclose data furnished under this clause, in accordance with subparagraph (h)(1) of this clause, in precedence over any other clause of this contract providing for rights in data.

(3) The Government is not precluded from using similar or identical data acquired from other sources.

(End of clause)

52.223-5 POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION (APR 1998)

(a) Executive Order 12856 of August 3, 1993, requires Federal facilities to comply with the provisions of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA)(42 U.S.C. 11001-11050) and the Pollution Prevention Act of 1990 (PPA)(42 U.S.C. 13101-13109).

(b) The Contractor shall provide all information needed by the Federal facility to comply with the emergency planning reporting requirements of Section 302 of EPCRA; the emergency notice requirements of Section 304 of EPCRA; the list of Material Safety Data Sheets required by Section 311 of EPCRA; the emergency and hazardous chemical inventory forms of Section 312 of EPCRA; the toxic chemical release inventory of Section 313 of EPCRA, which includes the reduction and recycling information required by Section 6607 of PPA; and the toxic chemical reduction goals requirements of Section 3-302 of Executive Order 12856.

(End of clause)

52.223-6 DRUG-FREE WORKPLACE (MAY 2001)

(a) Definitions. As used in this clause --

"Controlled substance" means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11 - 1308.15.

"Conviction" means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes.

"Criminal drug statute" means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession, or use of any controlled substance.

"Drug-free workplace" means the site(s) for the performance of work done by the Contractor in connection with a specific contract at which employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

"Employee" means an employee of a Contractor directly engaged in the performance of work under a Government contract. "Directly engaged" is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

"Individual" means an offeror/contractor that has no more than one employee including the offeror/contractor.

(b) The Contractor, if other than an individual, shall-- within 30 days after award (unless a longer period is agreed to in writing for contracts of 30 days or more performance duration), or as soon as possible for contracts of less than 30 days performance duration--

(1) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition;

- (2) Establish an ongoing drug-free awareness program to inform such employees about--
 - (i) The dangers of drug abuse in the workplace;
 - (ii) The Contractor's policy of maintaining a drug-free workplace;
 - (iii) Any available drug counseling, rehabilitation, and employee assistance programs; and
 - (iv) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;
- (3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b)(1) of this clause;
- (4) Notify such employees in writing in the statement required by subparagraph (b)(1) of this clause that, as a condition of continued employment on this contract, the employee will--
 - (i) Abide by the terms of the statement; and
 - (ii) Notify the employer in writing of the employee's conviction under a criminal drug statute for a violation occurring in the workplace no later than 5 days after such conviction.
- (5) Notify the Contracting Officer in writing within 10 days after receiving notice under subdivision (b)(4)(ii) of this clause, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee;
- (6) Within 30 days after receiving notice under subdivision (b)(4)(ii) of this clause of a conviction, take one of the following actions with respect to any employee who is convicted of a drug abuse violation occurring in the workplace:
 - (i) Taking appropriate personnel action against such employee, up to and including termination; or
 - (ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency; and
- (7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b)(1) through (b)(6) of this clause.
- (c) The Contractor, if an individual, agrees by award of the contract or acceptance of a purchase order, not to engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance while performing this contract.
- (d) In addition to other remedies available to the Government, the Contractor's failure to comply with the requirements of paragraph (b) or (c) of this clause may, pursuant to FAR 23.506, render the Contractor subject to suspension of contract payments, termination of the contract for default, and suspension or debarment.
- (End of clause)

52.223-14 TOXIC CHEMICAL RELEASE REPORTING (OCT 2000)

- (a) Unless otherwise exempt, the Contractor, as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-

to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor owned or operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if--

(1) The facility does not manufacture, process, or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

(2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

(3) The facility does not meet the reporting thresholds of toxic chemicals established under of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

(4) The facility does not fall within Standard Industrial Classification Code (SIC) major groups 20 through 39 or their corresponding North American Industry Classification System (NAICS) sectors 31 through 33; or

(5) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any of its owned or operated facilities used in the performance of this contract is no longer exempt--

(1) The Contractor shall notify the Contracting Officer; and

(2) The Contractor, as owner or operator of a facility used in the performance of this contract that is no longer exempt, shall (i) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year during which the facility becomes eligible; and (ii) continue to file the annual Form R for the life of the contract for such facility.

(d) The Contracting Officer may terminate this contract or take other action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items, as defined in FAR Part 2, the Contractor shall--

(1) For competitive subcontracts expected to exceed \$100,000 (including all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding \$100,000 (including all options), the substance of this clause, except this paragraph (e).

(End of clause)

52.225-11 BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (JUL 2002)

(a) Definitions. As used in this clause--

Component means an article, material, or supply incorporated directly into a construction material.

Construction material means an article, material, or supply brought to the construction site by the Contractor or subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

Cost of components means--

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the construction material (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the end product.

Designated country means any of the following countries: Aruba, Austria, Bangladesh, Belgium, Benin, Bhutan, Botswana, Burkina Faso, Burundi, Canada, Cape Verde, Central African Republic, Chad, Comoros, Denmark.

Djibouti, Equatorial Guinea, Finland, France, Gambia, Germany, Greece, Guinea, Guinea-Bissau, Haiti, Hong Kong, Ireland, Israel, Italy, Japan.

Kiribati, Korea, Republic of, Lesotho, Liechtenstein, Luxembourg, Malawi, Maldives, Mali, Mozambique, Nepal, Netherlands, Niger, Norway, Portugal, Rwanda.

Sao Tome and Principe, Sierra Leone, Singapore, Somalia, Spain, Sweden, Switzerland, Tanzania U.R., Togo, Tuvalu, Uganda, United Kingdom, Vanuatu, Western Samoa, Yemen.

Designated country construction material means a construction material that--

(1) Is wholly the growth, product, or manufacture of a designated country; or

(2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

Domestic construction material means--

(1) An unmanufactured construction material mined or produced in the United States; or

(2) A construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic.

Foreign construction material means a construction material other than a domestic construction material.

North American Free Trade Agreement country means Canada or Mexico.

North American Free Trade Agreement country construction material means a construction material that--

- (1) Is wholly the growth, product, or manufacture of a North American Free Trade Agreement (NAFTA) country; or
- (2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

United States means the 50 States and the District of Columbia, U.S. territories and possessions, Puerto Rico, the Northern Mariana Islands, and any other place subject to U.S. jurisdiction, but does not include leased bases.

(b) Construction materials. (1) This clause implements the Buy American Act (41 U.S.C. 10a-10d) and the Balance of Payments Program by providing a preference for domestic construction material. In addition, the Contracting Officer has determined that the Trade Agreements Act and the North American Free Trade Agreement (NAFTA) apply to this acquisition. Therefore, the Buy American Act restrictions are waived for designated country and NAFTA country construction materials.

(2) The Contractor shall use only domestic, designated country, or NAFTA country construction material in performing this contract, except as provided in paragraphs (b)(3) and (b)(4) of this clause.

(3) The requirement in paragraph (b)(2) of this clause does not apply to the construction materials or components listed by the Government as follows: (Contracting Officer to list applicable excepted materials or indicate "none")

(4) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(3) of this clause if the Government determines that--

- (i) The cost of domestic construction material would be unreasonable. The cost of a particular domestic construction material subject to the restrictions of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent;
- (ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or
- (iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) Request for determination of inapplicability of the Buy American Act.

(1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(4) of this clause shall include adequate information for Government evaluation of the request, including--

- (A) A description of the foreign and domestic construction materials;
- (B) Unit of measure;
- (C) Quantity;
- (D) Price;
- (E) Time of delivery or availability;
- (F) Location of the construction project;

- (G) Name and address of the proposed supplier; and
- (H) A detailed justification of the reason for use of foreign construction materials cited in accordance with paragraph (b)(3) of this clause.
- (ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.
- (iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).
- (iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.
- (2) If the Government determines after contract award that an exception to the Buy American Act applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(4)(i) of this clause.
- (3) Unless the Government determines that an exception to the Buy American Act applies, use of foreign construction material is noncompliant with the Buy American Act.
- (d) Data. To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

Foreign and Domestic Construction Materials Price Comparison			
Construction material description	Unit of measure	Quantity	Price (dollars) \1\
Item 1:			
Foreign construction material....			
Domestic construction material...			
Item 2:			
Foreign construction material....			
Domestic construction material...			
\1\ Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).			
List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.			
Include other applicable supporting information.			
(End of clause)			

52.225-13 RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (JUL 2000)

- (a) The Contractor shall not acquire, for use in the performance of this contract, any supplies or services originating from sources within, or that were located in or transported from or through, countries whose products are banned from importation into the United States under regulations of the Office of Foreign

Assets Control, Department of the Treasury. Those countries are Cuba, Iran, Iraq, Libya, North Korea, Sudan, the territory of Afghanistan controlled by the Taliban, and Serbia (excluding the territory of Kosovo).

(b) The Contractor shall not acquire for use in the performance of this contract any supplies or services from entities controlled by the government of Iraq.

(c) The Contractor shall insert this clause, including this paragraph (c), in all subcontracts.

(End of clause)

52.227-1 AUTHORIZATION AND CONSENT (JUL 1995)

(a) The Government authorizes and consents to all use and manufacture, in performing this contract or any subcontract at any tier, of any invention described in and covered by a United States patent (1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or (2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with (i) specifications or written provisions forming a part of this contract or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold (however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.)

(End of clause)

52.227-4 PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984)

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any United States patent (except a patent issued upon an application that is now or may hereafter be withheld from issue pursuant to a Secrecy Order under 35 U.S.C. 181) arising out of performing this contract or out of the use or disposal by or for the account of the Government of supplies furnished or work performed under this contract.

(End of clause)

52.228-11 PLEDGES OF ASSETS (FEB 1992)

(a) Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond--

(1) Pledge of assets; and

(2) Standard Form 28, Affidavit of Individual Surety.

(b) Pledges of assets from each person acting as an individual surety shall be in the form of--

(1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government securities held in book entry form) and/or;

(2) A recorded lien on real estate. The offeror will be required to provide--

(i) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owners; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(ii) Evidence of the amount due under any encumbrance shown in the evidence of title;

(iii) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation.

(End of clause)

52.229-3 FEDERAL, STATE, AND LOCAL TAXES (JAN 1991)

(a) "Contract date," as used in this clause, means the date set for bid opening or, if this is a negotiated contract or a modification, the effective date of this contract or modification.

"All applicable Federal, State, and local taxes and duties," as used in this clause, means all taxes and duties, in effect on the contract date, that the taxing authority is imposing and collecting on the transactions or property covered by this contract.

"After-imposed Federal tax," as used in this clause, means any new or increased Federal excise tax or duty, or tax that was exempted or excluded on the contract date but whose exemption was later revoked or reduced during the contract period, on the transactions or property covered by this contract that the Contractor is required to pay or bear as the result of legislative, judicial, or administrative action taking effect after the contract date. It does not include social security tax or other employment taxes.

"After-relieved Federal tax," as used in this clause, means any amount of Federal excise tax or duty, except social security or other employment taxes, that would otherwise have been payable on the transactions or property covered by this contract, but which the Contractor is not required to pay or bear, or for which the Contractor obtains a refund or drawback, as the result of legislative, judicial, or administrative action taking effect after the contract date.

(b) The contract price includes all applicable Federal, State, and local taxes and duties.

(c) The contract price shall be increased by the amount of any after-imposed Federal tax, provided the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price, as a contingency reserve or otherwise.

(d) The contract price shall be decreased by the amount of any after-relieved Federal tax.

(e) The contract price shall be decreased by the amount of any Federal excise tax or duty, except social security or other employment taxes, that the Contractor is required to pay or bear, or does not obtain a refund of, through the Contractor's fault, negligence, or failure to follow instructions of the Contracting Officer.

(f) No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceeds \$250.

(g) The Contractor shall promptly notify the Contracting Officer of all matters relating to any Federal excise tax or duty that reasonably may be expected to result in either an increase or decrease in the contract price and shall take appropriate action as the Contracting Officer directs.

(h) The Government shall, without liability, furnish evidence appropriate to establish exemption from any Federal, State, or local tax when the Contractor requests such evidence and a reasonable basis exists to sustain the exemption.

(End of clause)

52.232-5 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (MAY 1997)

(a) Payment of price. The Government shall pay the Contractor the contract price as provided in this contract.

(b) Progress payments. The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer.

(1) The Contractor's request for progress payments shall include the following substantiation:

(i) An itemization of the amounts requested, related to the various elements of work required by the contract covered by the payment requested.

(ii) A listing of the amount included for work performed by each subcontractor under the contract.

(iii) A listing of the total amount of each subcontract under the contract.

(iv) A listing of the amounts previously paid to each such subcontractor under the contract.

(v) Additional supporting data in a form and detail required by the Contracting Officer.

(2) In the preparation of estimates, the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site also may be taken into consideration if--

(i) Consideration is specifically authorized by this contract; and

(ii) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) Contractor certification. Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made: (However, if the Contractor elects to delete paragraph (c)(4) from the certification, the certification is still acceptable.)

I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the

contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of chapter 39 of Title 31, United States Code;

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and

(4) This certification is not to be construed as final acceptance of a subcontractor's performance.

(Name)

(Title)

(Date)

(d) Refund of unearned amounts. If the Contractor, after making a certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this contract (hereinafter referred to as the "unearned amount"), the Contractor shall--

(1) Notify the Contracting Officer of such performance deficiency; and

(2) Be obligated to pay the Government an amount (computed by the Contracting Officer in the manner provided in paragraph (j) of this clause) equal to interest on the unearned amount from the 8th day after the date of receipt of the unearned amount until--

(i) The date the Contractor notifies the Contracting Officer that the performance deficiency has been corrected; or

(ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

(e) Retainage. If the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved. When the work is substantially complete, the Contracting Officer may retain from previously withheld funds and future progress payments that amount the Contracting Officer considers adequate for protection of the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the contract, for which the price is stated separately in the contract, payment shall be made for the completed work without retention of a percentage.

(f) Title, liability, and reservation of rights. All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

(1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

(2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(g) Reimbursement for bond premiums. In making these progress payments, the Government shall, upon request, reimburse the Contractor for the amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor has furnished evidence of full payment to the surety. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of progress payments attributable to bond premiums.

(h) Final payment. The Government shall pay the amount due the Contractor under this contract after--

(1) Completion and acceptance of all work;

(2) Presentation of a properly executed voucher; and

(3) Presentation of release of all claims against the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U.S.C. 3727 and 41 U.S.C. 15).

(i) Limitation because of undefinitized work. Notwithstanding any provision of this contract, progress payments shall not exceed 80 percent on work accomplished on undefinitized contract actions. A "contract action" is any action resulting in a contract, as defined in FAR Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes.

(j) Interest computation on unearned amounts. In accordance with 31 U.S.C. 3903(c)(1), the amount payable under subparagraph (d)(2) of this clause shall be--

(1) Computed at the rate of average bond equivalent rates of 91-day Treasury bills auctioned at the most recent auction of such bills prior to the date the Contractor receives the unearned amount; and

(2) Deducted from the next available payment to the Contractor.

(End of clause)

52.232-17 INTEREST (JUNE 1996)

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid. reproduce, prepare derivative works, distribute copies to the public, and (b) Amounts shall be due at the earliest of the following dates:

(1) The date fixed under this contract.

(2) The date of the first written demand for payment consistent with this contract, including any demand resulting from a default termination.

(3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.

(4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.

(c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

(End of clause)

52.232-23 ASSIGNMENT OF CLAIMS (JAN 1986)

(a) The Contractor, under the Assignment of Claims Act, as amended, 31 U.S.C. 3727, 41 U.S.C. 15 (hereafter referred to as "the Act"), may assign its rights to be paid amounts due or to become due as a result of the performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency. The assignee under such an assignment may thereafter further assign or reassign its right under the original assignment to any type of financing institution described in the preceding sentence.

(b) Any assignment or reassignment authorized under the Act and this clause shall cover all unpaid amounts payable under this contract, and shall not be made to more than one party, except that an assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in the financing of this contract.

(c) The Contractor shall not furnish or disclose to any assignee under this contract any classified document (including this contract) or information related to work under this contract until the Contracting Officer authorizes such action in writing.

(End of clause)

52.232-27 PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (FEB 2002)

Notwithstanding any other payment terms in this contract, the Government will make invoice payments under the terms and conditions specified in this clause. The Government considers payment as being made on the day a check is dated or the date of an electronic funds transfer. Definitions of pertinent terms are set forth in sections 2.101, 32.001, and 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see paragraph (a)(3) concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) Invoice payments--(1) Types of invoice payments. For purposes of this clause, there are several types of invoice payments that may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project.

(A) The due date for making such payments is 14 days after the designated billing office receives a proper payment request. If the designated billing office fails to annotate the payment request with the actual date of receipt at the time of receipt, the payment due date is the 14th day after the date of the Contractor's payment request, provided the designated billing office receives a proper payment request and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, is as specified in the contract or, if not specified, 30 days after approval by the Contracting Officer for release to the Contractor.

(ii) Final payments based on completion and acceptance of all work and presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the Government (e.g., each separate building, public work, or other division of the contract for which the price is stated separately in the contract).

(A) The due date for making such payments is the later of the following two events:

(1) The 30th day after the designated billing office receives a proper invoice from the Contractor.

(2) The 30th day after Government acceptance of the work or services completed by the Contractor. For a final invoice when the payment amount is subject to contract settlement actions (e.g., release of claims), acceptance is deemed to occur on the effective date of the contract settlement.

(B) If the designated billing office fails to annotate the invoice with the date of actual receipt at the time of receipt, the invoice payment due date is the 30th day after the date of the Contractor's invoice, provided the designated billing office receives a proper invoice and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(2) Contractor's invoice. The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in paragraphs (a)(2)(i) through (a)(2)(xi) of this clause. If the invoice does not comply with these requirements, the designated billing office must return it within 7 days after receipt, with the reasons why it is not a proper invoice. When computing any interest penalty owed the Contractor, the Government will take into account if the Government notifies the Contractor of an improper invoice in an untimely manner.

(i) Name and address of the Contractor.

(ii) Invoice date and invoice number. (The Contractor should date invoices as close as possible to the date of mailing or transmission.)

(iii) Contract number or other authorization for work or services performed (including order number and contract line item number).

(iv) Description of work or services performed.

(v) Delivery and payment terms (e.g., discount for prompt payment terms).

(vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).

(vii) Name (where practicable), title, phone number, and mailing address of person to notify in the event of a defective invoice.

(viii) For payments described in paragraph (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts.

(ix) Taxpayer Identification Number (TIN). The Contractor shall include its TIN on the invoice only if required elsewhere in this contract.

(x) Electronic funds transfer (EFT) banking information.

(A) The Contractor shall include EFT banking information on the invoice only if required elsewhere in this contract.

(B) If EFT banking information is not required to be on the invoice, in order for the invoice to be a proper invoice, the Contractor shall have submitted correct EFT banking information in accordance with the applicable solicitation provision (e.g., 52.232-38, Submission of Electronic Funds Transfer Information with Offer), contract clause (e.g., 52.232-33, Payment by Electronic Funds Transfer--Central Contractor Registration, or 52.232-34, Payment by Electronic Funds Transfer--Other Than Central Contractor Registration), or applicable agency procedures.

(C) EFT banking information is not required if the Government waived the requirement to pay by EFT.

(xi) Any other information or documentation required by the contract.

(3) Interest penalty. The designated payment office will pay an interest penalty automatically, without request from the Contractor, if payment is not made by the due date and the conditions listed in paragraphs (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday, the designated payment office may make payment on the following working day without incurring a late payment interest penalty.

(i) The designated billing office received a proper invoice.

(ii) The Government processed a receiving report or other Government documentation authorizing payment and there was no disagreement over quantity, quality, Contractor compliance with any contract term or condition, or requested progress payment amount.

(iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) Computing penalty amount. The Government will compute the interest penalty in accordance with the Office of Management and Budget prompt payment regulations at 5 CFR part 1315.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in paragraph (a)(1)(ii) of this clause, Government acceptance or approval is deemed to occur constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. If actual acceptance or approval occurs within the constructive acceptance or approval period, the Government will base the determination of an interest penalty on the actual date of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contractor estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The prompt payment regulations at 5 CFR 1315.10(c) do not require the Government to pay interest penalties if payment delays are due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. The Government and the Contractor shall resolve claims involving disputes, and any interest that may be payable in accordance with the clause at FAR 52.233-1, Disputes.

(5) Discounts for prompt payment. The designated payment office will pay an interest penalty automatically, without request from the Contractor, if the Government takes a discount for prompt payment improperly. The Government will calculate the interest penalty in accordance with the prompt payment regulations at 5 CFR part 1315.

(6) Additional interest penalty. (i) The designated payment office will pay a penalty amount, calculated in accordance with the prompt payment regulations at 5 CFR part 1315 in addition to the interest penalty amount only if--

(A) The Government owes an interest penalty of \$1 or more;

(B) The designated payment office does not pay the interest penalty within 10 days after the date the invoice amount is paid; and

(C) The Contractor makes a written demand to the designated payment office for additional penalty payment, in accordance with paragraph (a)(6)(ii) of this clause, postmarked not later than 40 days after the date the invoice amount is paid.

(ii)(A) The Contractor shall support written demands for additional penalty payments with the following data. The Government will not request any additional data. The Contractor shall--

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest was due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) If there is no postmark or the postmark is illegible--

(1) The designated payment office that receives the demand will annotate it with the date of receipt provided the demand is received on or before the 40th day after payment was made; or

(2) If the designated payment office fails to make the required annotation, the Government will determine the demand's validity based on the date the Contractor has placed on the demand, provided such date is no later than the 40th day after payment was made.

(b) Contract financing payments. If this contract provides for contract financing, the Government will make contract financing payments in accordance with the applicable contract financing clause.

(c) Subcontract clause requirements. The Contractor shall include in each subcontract for property or services (including a material supplier) for the purpose of performing this contract the following:

(1) Prompt payment for subcontractors. A payment clause that obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under this contract.

(2) Interest for subcontractors. An interest penalty clause that obligates the Contractor to pay to the subcontractor an interest penalty for each payment not made in accordance with the payment clause--

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due is made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(3) Subcontractor clause flowdown. A clause requiring each subcontractor to use:

- (i) Include a payment clause and an interest penalty clause conforming to the standards set forth in paragraphs (c)(1) and (c)(2) of this clause in each of its subcontracts; and
 - (ii) Require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.
- (d) Subcontract clause interpretation. The clauses required by paragraph (c) of this clause shall not be construed to impair the right of the Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions that--
- (1) Retainage permitted. Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to by the parties to the subcontract, giving such recognition as the parties deem appropriate to the ability of a subcontractor to furnish a performance bond and a payment bond;
 - (2) Withholding permitted. Permit the Contractor or subcontractor to make a determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and
 - (3) Withholding requirements. Permit such withholding without incurring any obligation to pay a late payment penalty if--
 - (i) A notice conforming to the standards of paragraph (g) of this clause previously has been furnished to the subcontractor; and
 - (ii) The Contractor furnishes to the Contracting Officer a copy of any notice issued by a Contractor pursuant to paragraph (d)(3)(i) of this clause.
- (e) Subcontractor withholding procedures. If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such subcontractor is subject to withholding from the subcontractor in accordance with the subcontract agreement, then the Contractor shall--
- (1) Subcontractor notice. Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;
 - (2) Contracting Officer notice. Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to paragraph (e)(1) of this clause;
 - (3) Subcontractor progress payment reduction. Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (e)(1) of this clause;
 - (4) Subsequent subcontractor payment. Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and--
 - (i) Make such payment within--
 - (A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefor must be recovered from the Government because of a reduction under paragraph (e)(5)(i)) of this clause; or
 - (B) Seven days after the Contractor recovers such funds from the Government; or

(ii) Incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) Notice to Contracting Officer. Notify the Contracting Officer upon--

(i) Reduction of the amount of any subsequent certified application for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment, specifying--

(A) The amounts withheld under paragraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) Interest to Government. Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C. 3903(c)(1)), from the 8th day after receipt of the withheld amounts from the Government until--

(i) The day the identified subcontractor performance deficiency is corrected; or

(ii) The date that any subsequent payment is reduced under paragraph (e)(5)(i) of this clause.

(f) Third-party deficiency reports--(1) Withholding from subcontractor. If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a "second-tier subcontractor") a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a deficiency in such first-tier subcontractor's performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, the Contractor may, without incurring an obligation to pay an interest penalty under paragraph (e)(6) of this clause--

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor's next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (f)(1)(i) of this clause.

(2) Subsequent payment or interest charge. As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall--

(i) Pay the amount withheld under paragraph (f)(1)(ii) of this clause to such first-tier subcontractor; or

(ii) Incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) Written notice of subcontractor withholding. The Contractor shall issue a written notice of any withholding to a subcontractor (with a copy furnished to the Contracting Officer), specifying--

(1) The amount to be withheld;

(2) The specific causes for the withholding under the terms of the subcontract; and

(3) The remedial actions to be taken by the subcontractor in order to receive payment of the amounts withheld.

(h) Subcontractor payment entitlement. The Contractor may not request payment from the Government of any amount withheld or retained in accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) Prime-subcontractor disputes. A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the Government is a party. The Government may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) Preservation of prime-subcontractor rights. Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) Non-recourse for prime contractor interest penalty. The Contractor's obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the Government for such interest penalty. A cost-reimbursement claim may not include any amount for reimbursement of such interest penalty.

(l) Overpayments. If the Contractor becomes aware of a duplicate payment or that the Government has otherwise overpaid on an invoice payment, the Contractor shall immediately notify the Contracting Officer and request instructions for disposition of the overpayment.

(End of clause)

52.233-1 Disputes. (JUL 2002)

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) Claim, as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding \$100,000 is not a claim under the Act until certified. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.

(2)(i) The contractors shall provide the certification specified in subparagraph (d)(2)(iii) of this clause when submitting any claim -

(A) Exceeding \$100,000; or

(B) Regardless of the amount claimed, when using -

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

(ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

(iii) The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor.

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of \$100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over \$100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use alternative dispute resolution (ADR). If the Contractor refuses an offer for ADR, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the request.

(h) The Government shall pay interest on the amount found due and unpaid from (1) the date the Contracting Officer receives the claim (certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in (FAR) 48 CFR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer.

(End of clause)

52.233-3 PROTEST AFTER AWARD (AUG. 1996)

(a) Upon receipt of a notice of protest (as defined in FAR 33.101) or a determination that a protest is likely (see FAR 33.102(d)), the Contracting Officer may, by written order to the Contractor, direct the Contractor to stop performance of the work called for by this contract. The order shall be specifically identified as a

stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Upon receipt of the final decision in the protest, the Contracting Officer shall either--

(1) Cancel the stop-work order; or

(2) Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the Government, clause of this contract.

(b) If a stop-work order issued under this clause is canceled either before or after a final decision in the protest, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if--

(1) The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and

(2) The Contractor asserts its right to an adjustment within 30 days after the end of the period of work stoppage; provided, that if the Contracting Officer decides the facts justify the action, the Contracting Officer may receive and act upon a proposal at any time before final payment under this contract.

(c) If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.

(d) If a stop-work order is not canceled and the work covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

(e) The Government's rights to terminate this contract at any time are not affected by action taken under this clause.

(f) If, as the result of the Contractor's intentional or negligent misstatement, misrepresentation, or miscertification, a protest related to this contract is sustained, and the Government pays costs, as provided in FAR 33.102(b)(2) or 33.104(h)(1), the Government may require the Contractor to reimburse the Government the amount of such costs. In addition to any other remedy available, and pursuant to the requirements of Subpart 32.6, the Government may collect this debt by offsetting the amount against any payment due the Contractor under any contract between the Contractor and the Government.

(End of clause)

52.236-2 DIFFERING SITE CONDITIONS (APR 1984)

As prescribed in 36.502, insert the following clause in solicitations and contracts when a fixed-price construction contract or a fixed-price dismantling, demolition, or removal of improvements contract is contemplated and the contract amount is expected to exceed the small purchase limitation. The Contracting Officer may insert the clause in solicitations and contracts when a fixed-price construction or a fixed-price contract for dismantling, demolition, or removal of improvements is contemplated and the contract amount is expected to be within the small purchase limitation.

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of

(1) subsurface or latent physical conditions at the site which differ materially from those indicated in this

contract, or

(2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; provided, that the time prescribed in (a) above for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

(End of clause)

52.236-3 SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984)

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to

(1) conditions bearing upon transportation, disposal, handling, and storage of materials;

(2) the availability of labor, water, electric power, and roads;

(3) uncertainties of weather, river stages, tides, or similar physical conditions at the site;

(4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

(b) The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

(End of clause)

52.236-5 MATERIAL AND WORKMANSHIP (APR 1984)

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new

and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

(End of clause)

52.236-6 SUPERINTENDENCE BY THE CONTRACTOR (APR 1984)

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the worksite a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

(End of clause)

52.236-7 PERMITS AND RESPONSIBILITIES (NOV 1991)

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(End of clause)

52.236-8 OTHER CONTRACTS (APR 1984)

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

(End of clause)

52.236-9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984)

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities

(1) at or near the work site, and

(2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(End of clause)

52.236-10 OPERATIONS AND STORAGE AREAS (APR 1984)

(a) The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

(b) Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(End of clause)

52.236-11 USE AND POSSESSION PRIOR TO COMPLETION (APR 1984)

(a) The Government shall have the right to take possession of or use any completed or partially completed

part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the Government has such possession or use, the Contractor shall be relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

(End of clause)

52.236-12 CLEANING UP (APR 1984)

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

(End of clause)

52.236-13 ACCIDENT PREVENTION (NOV 1991)

(a) The Contractor shall provide and maintain work environments and procedures which will

(1) safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities;

(2) avoid interruptions of Government operations and delays in project completion dates; and

(3) control costs in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall-

(1) Provide appropriate safety barricades, signs, and signal lights;

(2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and

(3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or

any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

- (d) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

(End of clause)

52.236-15 SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984)

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately deliver three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

(End of clause)

52.236-17 LAYOUT OF WORK (APR 1984)

The Contractor shall lay out its work from Government established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor

or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(End of clause)

52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997)

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean "approved by," or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown," "as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place," that is "furnished and installed".

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements, and (2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set

will be returned to the Contractor.

(End of clause)

52.236-26 PRECONSTRUCTION CONFERENCE (FEB 1995)

If the Contracting Officer decides to conduct a preconstruction conference, the successful offeror will be notified and will be required to attend. The Contracting Officer's notification will include specific details regarding the date, time, and location of the conference, any need for attendance by subcontractors, and information regarding the items to be discussed.

(End of clause)

52.242-13 BANKRUPTCY (JUL 1995)

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification shall be furnished within five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

(End of clause)

52.242-14 SUSPENSION OF WORK (APR 1984)

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract. (c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

(End of clause)

52.243-4 CHANGES (AUG 1987)

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

- (1) In the specifications (including drawings and designs);
- (2) In the method or manner of performance of the work;
- (3) In the Government-furnished facilities, equipment, materials, services, or site; or
- (4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating

- (1) the date, circumstances, and source of the order and
- (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after

(1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(End of clause)

52.246-12 INSPECTION OF CONSTRUCTION (AUG 1996)

(a) Definition. "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be

conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not--

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;

(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;

(3) Constitute or imply acceptance; or

(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) of this section.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

(End of clause)

52.246-21 WARRANTY OF CONSTRUCTION (MAR 1994)

(a) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (i) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

(b) This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(c) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished.

(d) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

(e) The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

(f) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(g) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

(h) In the event the Contractor's warranty under paragraph (b) of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(i) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

(j) This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

(End of clause)

(a) General. The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) below.

(b) Definitions. "Collateral costs," as used in this clause, means agency costs of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause, means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs, including subcontractors' development and implementation costs (see paragraph (h) below).

"Value engineering change proposal (VECP)" means a proposal that--

- (1) Requires a change to this, the instant contract, to implement; and
- (2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; provided, that it does not involve a change--
 - (i) In deliverable end item quantities only; or
 - (ii) To the contract type only.

(c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

- (1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.
- (2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.
- (3) A separate, detailed cost estimate for
 - (i) the affected portions of the existing contract requirement and
 - (ii) the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) below.

(4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.

(5) A prediction of any effects the proposed change would have on collateral costs to the agency.

(6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.

(7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.

(d) Submission. The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

(e) Government action.

(1) The Contracting Officer will notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer will notify the Contractor within the 45-day period and provide the reason for the delay and the expected date of the decision. The Government will process VECP's expeditiously; however, it shall not be liable for any delay in acting upon a VECP.

If the VECP is not accepted, the Contracting Officer will notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The decision to accept or reject all or part of any VECP is a unilateral decision made solely at the discretion of the Contracting Officer.

(f) Sharing.

(1) Rates. The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by

(i) 45 percent for fixed-price contracts or

(ii) 75 percent for cost-reimbursement contracts.

(2) Payment. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

(i) Accept the VECP;

(ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and

(iii) Provide the Contractor's share of savings by adding the amount calculated to the contract price or fee.

(g) Collateral savings. If a VECP is accepted, the Contracting Officer will increase the instant contract amount by 20 percent of any projected collateral savings determined to be realized in a typical year of use

after subtracting any Government costs not previously offset. However, the Contractor's share of collateral savings will not exceed the contract's firm-fixed-price or estimated cost, at the time the VECP is accepted, or \$100,000, whichever is greater. The Contracting Officer is the sole determiner of the amount of collateral savings.

(h) Subcontracts. The Contractor shall include an appropriate value engineering clause in any subcontract of \$50,000 or more and may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; provided, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(i) Data. The Contractor may restrict the Government's right to use any part of a VECP or the supporting data by marking the following legend on the affected parts:

"These data, furnished under the Value Engineering-- Construction clause of contract , shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations." If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification implementing the VECP and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of clause)

52.249-2 TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (SEP 1996)

(a) The Government may terminate performance of work under this contract in whole or, from time to time, in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination, and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

(1) Stop work as specified in the notice.

(2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.

(3) Terminate all subcontracts to the extent they relate to the work terminated.

(4) Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle or to pay any termination settlement proposal arising out of those terminations.

(5) With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.

(6) As directed by the Contracting Officer, transfer title and deliver to the Government (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Government.

(7) Complete performance of the work not terminated.

(8) Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.

(9) Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in subparagraph (b)(6) of this clause; provided, however, that the Contractor (i) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.

(c) The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.

(d) After expiration of the plant clearance period as defined in Subpart 45.6 of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.

(e) After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1-year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of information available, the amount, if any, due the Contractor because of the termination and shall pay the amount determined.

(f) Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid or remaining to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (g) or paragraph (g) of this clause, exclusive of costs shown in subparagraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be modified, and the Contractor paid the agreed amount. Paragraph (g) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(g) If the Contractor and the Contracting Officer fail to agree on the whole amount to be paid because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined by the Contracting Officer as follows, but without duplication of any amounts agreed on under paragraph (f) of this clause:

(1) The contract price for completed supplies or services accepted by the Government (or sold or acquired under subparagraph (b)(9) of this clause) not previously paid for, adjusted for any saving of freight and other charges.

(2) The total of--

(i) The costs incurred in the performance of the work terminated, including initial costs and preparatory expense allocable thereto, but excluding any costs attributable to supplies or services paid or to be paid under subparagraph (f)(1) of this clause;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(2)(i) of this clause; and

(iii) A sum, as profit on subdivision (g)(2)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(3) The reasonable costs of settlement of the work terminated, including--

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(h) Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.

(i) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.

(j) The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or (l) of this clause, except that if the Contractor failed to submit the termination settlement proposal or request for equitable adjustment within the time provided in paragraph (e) or (l), respectively, and failed to request a time extension, there is no right of appeal.

(k) In arriving at the amount due the Contractor under this clause, there shall be deducted--

(1) All unliquidated advance or other payments to the Contractor under the terminated portion of this contract;

(2) Any claim which the Government has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.

(l) If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Contracting Officer.

(m)(1) The Government may, under the terms and conditions it prescribes, make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.

(n) Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

(End of clause)

52.249-10 DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984)

(a) If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time, the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the Government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.

(b) The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if--

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include

(i) acts of God or of the public enemy,

(ii) acts of the Government in either its sovereign or contractual capacity,

- (iii) acts of another Contractor in the performance of a contract with the Government,
- (iv) fires,
- (v) floods,
- (vi) epidemics,
- (vii) quarantine restrictions,
- (viii) strikes,
- (ix) freight embargoes,
- (x) unusually severe weather, or delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

[Insert one or more Internet addresses]

(End of clause)

52.252-4 ALTERATIONS IN CONTRACT (APR 1984)

Portions of this contract are altered as follows:

(End of clause)

52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (APR 1984)

(a) The use in this solicitation or contract of any Federal Acquisition Regulation (48 CFR Chapter 1) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the clause.

(e) The use in this solicitation or contract of any _____ (48 CFR _____) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

52.253-1 COMPUTER GENERATED FORMS (JAN 1991)

(a) Any data required to be submitted on a Standard or Optional Form prescribed by the Federal Acquisition Regulation (FAR) may be submitted on a computer generated version of the form, provided there is no change to the name, content, or sequence of the data elements on the form, and provided the form carries the Standard or Optional Form number and edition date.

(b) Unless prohibited by agency regulations, any data required to be submitted on an agency unique form prescribed by an agency supplement to the FAR may be submitted on a computer generated version of the form provided there is no change to the name, content, or sequence of the data elements on the form and provided the form carries the agency form number and edition date.

(f) If the Contractor submits a computer generated version of a form that is different than the required form, then the rights and obligations of the parties will be determined based on the content of the required form.

(End of clause)

252.201-7000 CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991)

(a) "Definition. Contracting officer's representative" means an individual designated in accordance with subsection 201.602-2 of the Defense Federal Acquisition Regulation Supplement and authorized in writing by the contracting officer to perform specific technical or administrative functions.

(b) If the Contracting Officer designates a contracting officer's representative (COR), the Contractor will receive a copy of the written designation. It will specify the extent of the COR's authority to act on behalf of the contracting officer. The COR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract.

(End of clause)

252.203-7001 PROHIBITION ON PERSONS CONVICTED OF FRAUD OR OTHER DEFENSE-CONTRACT-RELATED FELONIES (MAR 1999)

(a) Definitions. As used in this clause—

(1) "Arising out of a contract with the DoD" means any act in connection with—

(i) Attempting to obtain;

(ii) Obtaining, or

(iii) Performing a contract or first-tier subcontract of any agency, department, or component of the Department of Defense (DoD).

(2) “Conviction of fraud or any other felony” means any conviction for fraud or a felony in violation of state or Federal criminal statutes, whether entered on a verdict or plea, including a plea of *nolo contendere*, for which sentence has been imposed.

(3) “Date of conviction” means the date judgment was entered against the individual.

(b) Any individual who is convicted after September 29, 1988, of fraud or any other felony arising out of a contract with the DoD is prohibited from serving--

(1) In a management or supervisory capacity on any DoD contract or first-tier subcontract;

(2) On the board of directors of any DoD contractor or first-tier subcontractor;

(3) As a consultant, agent, or representative for any DoD contractor or first-tier subcontractor; or

(4) In any other capacity with the authority to influence, advise, or control the decisions of any DoD contractor or subcontractor with regard to any DoD contract or first-tier subcontract.

(c) Unless waived, the prohibition in paragraph (b) of this clause applies for not less than 5 years from the date of conviction.

(d) 10 U.S.C. 2408 provides that a defense contractor or first-tier subcontractor shall be subject to a criminal penalty of not more than \$500,000 if convicted of knowingly—

(1) Employing a person under a prohibition specified in paragraph (b) of this clause; or

(2) Allowing such a person to serve on the board of directors of the contractor or first-tier subcontractor.

(e) In addition to the criminal penalties contained in 10 U.S.C. 2408, the Government may consider other available remedies, such as—

(1) Suspension or debarment;

(2) Cancellation of the contract at no cost to the Government; or

(3) Termination of the contract for default.

(f) The Contractor may submit written requests for waiver of the prohibition in paragraph (b) of this clause to the Contracting Officer. Requests shall clearly identify—

(1) The person involved;

(2) The nature of the conviction and resultant sentence or punishment imposed;

(3) The reasons for the requested waiver; and

(4) An explanation of why a waiver is in the interest of national security.

(g) The Contractor agrees to include the substance of this clause, appropriately modified to reflect the identity and relationship of the parties, in all first-tier subcontracts exceeding the simplified acquisition

threshold in Part 2 of the Federal Acquisition Regulation, except those for commercial items or components.

(h) Pursuant to 10 U.S.C. 2408(c), defense contractors and subcontractors may obtain information as to whether a particular person has been convicted of fraud or any other felony arising out of a contract with the DoD by contacting The Office of Justice Programs, The Denial of Federal Benefits Office, U.S. Department of Justice, telephone (202) 616-3507.

(End of clause)

252.203-7002 DISPLAY OF DOD HOTLINE POSTER (DEC 1991)

(a) The Contractor shall display prominently in common work areas within business segments performing work under Department of Defense (DoD) contracts, DoD Hotline Posters prepared by the DoD Office of the Inspector General.

(b) DoD Hotline Posters may be obtained from the DoD Inspector General, ATTN: Defense Hotline, 400 Army Navy Drive, Washington, DC 22202-2884.

(g) The Contractor need not comply with paragraph (a) of this clause if it has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

(End of clause)

252.204-7000 DISCLOSURE OF INFORMATION (DEC 1991)

(a) The Contractor shall not release to anyone outside the Contractor's organization any unclassified information, regardless of medium (e.g., film, tape, document), pertaining to any part of this contract or any program related to this contract, unless--

(1) The Contracting Officer has given prior written approval; or

(2) The information is otherwise in the public domain before the date of release.

(b) Requests for approval shall identify the specific information to be released, the medium to be used, and the purpose for the release. The Contractor shall submit its request to the Contracting Officer at least 45 days before the proposed date for release.

(c) The Contractor agrees to include a similar requirement in each subcontract under this contract. Subcontractors shall submit requests for authorization to release through the prime contractor to the Contracting Officer.

(End of clause)

252.205-7000 PROVISION OF INFORMATION TO COOPERATIVE AGREEMENT HOLDERS (DEC 1991)

(a) Definition.

"Cooperative agreement holder" means a State or local government; a private, nonprofit organization; a tribal organization (as defined in section 4(c) of the Indian Self-Determination and Education Assistance Act (Pub. L. 93-268; 25 U.S.C. 450 (c))); or an economic enterprise (as defined in section 3(e) of the Indian Financing Act of 1974 (Pub. L. 93-362; 25 U.S.C. 1452(e))) whether such economic enterprise is organized for profit or nonprofit purposes; which has an agreement with the Defense Logistics Agency to furnish procurement technical assistance to business entities.

(b) The Contractor shall provide cooperative agreement holders, upon their request, with a list of those appropriate employees or offices responsible for entering into subcontracts under defense contracts. The list shall include the business address, telephone number, and area of responsibility of each employee or office.

(c) The Contractor need not provide the listing to a particular cooperative agreement holder more frequently than once a year.

(End of clause)

252.209-7000 ACQUISITION FROM SUBCONTRACTORS SUBJECT TO ONSITE INSPECTION UNDER THE INTERMEDIATE-RANGE NUCLEAR FORCES (INF) TREATY (NOV 1995)

(a) The Contractor shall not deny consideration for a subcontract award under this contract to a potential subcontractor subject to on-site inspection under the INF Treaty, or a similar treaty, solely or in part because of the actual or potential presence of Soviet inspectors at the subcontractor's facility, unless the decision is approved by the Contracting Officer.

(b) The Contractor shall incorporate this clause, including this paragraph (b), in all solicitations and contracts exceeding the simplified acquisition threshold in part 13 of the Federal Acquisition Regulation, except those for commercial items.

(End of clause)

252.223-7004 DRUG-FREE WORK FORCE (SEP 1988)

(a) Definitions.

(1) "Employee in a sensitive position," as used in this clause, means an employee who has been granted access to classified information; or employees in other positions that the Contractor determines involve national security; health or safety, or functions other than the foregoing requiring a high degree of trust and confidence.

(2) "Illegal drugs," as used in this clause, means controlled substances included in Schedules I and II, as defined by section 802(6) of title 21 of the United States Code, the possession of which is unlawful under chapter 13 of that Title. The term "illegal drugs" does not mean the use of a controlled substance pursuant to a valid prescription or other uses authorized by law.

(b) The Contractor agrees to institute and maintain a program for achieving the objective of a drug-free work force. While this clause defines criteria for such a program, contractors are encouraged to implement alternative approaches comparable to the criteria in paragraph (c) that are designed to achieve the objectives of this clause.

(c) Contractor programs shall include the following, or appropriate alternatives:

(1) Employee assistance programs emphasizing high level direction, education, counseling, rehabilitation, and coordination with available community resources;

(2) Supervisory training to assist in identifying and addressing illegal drug use by Contractor employees;

(3) Provision for self-referrals as well as supervisory referrals to treatment with maximum respect for individual confidentiality consistent with safety and security issues;

(4) Provision for identifying illegal drug users, including testing on a controlled and carefully monitored basis. Employee drug testing programs shall be established taking account of the following:

(i) The Contractor shall establish a program that provides for testing for the use of illegal drugs by employees in sensitive positions. The extent of and criteria for such testing shall be determined by the Contractor based on considerations that include the nature of the work being performed under the contract, the employee's duties, and efficient use of Contractor resources, and the risks to health, safety, or national security that could result from the failure of an employee adequately to discharge his or her position.

(ii) In addition, the Contractor may establish a program for employee drug testing--

(A) When there is a reasonable suspicion that an employee uses illegal drugs; or

(B) When an employees has been involved in an accident or unsafe practice;

(C) As part of or as a follow-up to counseling or rehabilitation for illegal drug use;

(D) As part of a voluntary employee drug testing program.

(iii) The Contractor may establish a program to test applicants for employment for illegal drug use.

(iv) For the purpose of administering this clause, testing for illegal drugs may be limited to those substances for which testing is prescribed by section 2..1 of subpart B of the "Mandatory Guidelines for Federal Workplace Drug Testing Programs" (53 FR 11980 (April 11, 1988), issued by the Department of Health and Human Services.

(d) Contractors shall adopt appropriate personnel procedures to deal with employees who are found to be using drugs illegally. Contractors shall not allow any employee to remain on duty or perform in a sensitive position who is found to use illegal drugs until such times as the Contractor, in accordance with procedures established by the Contractor, determines that the employee may perform in such a position.

(e) The provisions of this clause pertaining to drug testing program shall not apply to the extent that are inconsistent with state or local law, or with an existing collective bargaining agreement; provided that with respect to the latter, the Contractor agrees those issues that are in conflict will be a subject of negotiation at the next collective bargaining session.

(End of clause)

252.219-7009 Section 8(a) Direct Award.

SECTION 8(a) DIRECT AWARD (JUN 1998)

(a) This contract is issued as a direct award between the contracting office and the 8(a) Contractor pursuant to the Memorandum of Understanding dated May 6, 1998, between the Small Business Administration (SBA) and the Department of Defense. Accordingly, the SBA is not a party to this contract. SBA does retain responsibility for 8(a) certification, for 8(a) eligibility determinations and related issues, and for providing counseling and assistance to the 8(a) Contractor under the 8(a) Program. The cognizant SBA district office is:

*[To be completed by the Contracting Officer
at the time of award]*

(b) The contracting office is responsible for administering the contract and for taking any action on behalf of the Government under the terms and conditions of the contract; provided that the contracting office shall give advance notice to the SBA before it issues a final notice terminating performance, either in whole or in part, under the contract. The contracting office also shall coordinate with the SBA prior to processing any novation agreement. The contracting office may assign contract administration functions to a contract administration office.

(c) The Contractor agrees that—

(1) It will notify the Contracting Officer, simultaneous with its notification to the SBA (as required by SBA's 8(a) regulations at 13 CFR 124.308), when the owner or owners upon whom 8(a) eligibility is based plan to relinquish ownership or control of the concern. Consistent with Section 407 of Pub. L. 100-656, transfer of ownership or control shall result in termination of the contract for convenience, unless the SBA waives the requirement for termination prior to the actual relinquishing of ownership and control; and

(2) It will not subcontract the performance of any of the requirements of this contract without the prior written approval of the SBA and the Contracting Officer.

(End of clause)

252.225-7012 Preference for Certain Domestic Commodities (APR 2002)

(a) Definitions. As used in this clause--

(1) Component means any item supplied to the Government as part of an end product or of another component.

(2) End product means supplies delivered under a line item of this contract.

(b) The Contractor shall deliver under this contract only such of the following items, either as end products or components, that have been grown, reprocessed, reused, or produced in the United States, its possessions, or Puerto Rico:

(1) Food.

(2) Clothing.

(3) Tents, tarpaulins, or covers.

(4) Cotton and other natural fiber products.

(5) Woven silk or woven silk blends.

(6) Spun silk yarn for cartridge cloth.

(7) Synthetic fabric, and coated synthetic fabric, including all textile fibers and yarns that are for use in such fabrics.

(8) Canvas products.

(9) Wool (whether in the form of fiber or yarn or contained in fabrics, materials, or manufactured articles).

(10) Any item of individual equipment (Federal Supply Class 8465) manufactured from or containing fibers, yarns, fabrics, or materials listed in this paragraph (b).

(c) This clause does not apply--

(1) To items listed in section 25.104(a) of the Federal Acquisition Regulation (FAR), or other items for which the Government has determined that a satisfactory quality and sufficient quantity cannot be acquired as and when needed at U.S. market prices;

(2) To end products incidentally incorporating cotton, other natural fibers, or wool, for which the estimated value of the cotton, other natural fibers, or wool--

(i) Is not more than 10 percent of the total price of the end product; and (ii) Does not exceed the simplified acquisition threshold in FAR part 2;

(3) To foods that have been manufactured or processed in the United States, its possessions, or Puerto Rico, regardless of where the foods (and any component if applicable) were grown or produced;

(4) To chemical warfare protective clothing produced in the countries listed in subsection 225.872-1 of the Defense FAR Supplement; or

(5) To fibers and yarns that are for use in synthetic fabric or coated synthetic fabric (but does apply to the synthetic or coated synthetic fabric itself), if--

(i) The fabric is to be used as a component of an end product that is not a textile product. Examples of textile products, made in whole or in part of fabric, include--

(A) Draperies, floor coverings, furnishings, and bedding (Federal Supply Group 72, Household and Commercial Furnishings and Appliances);

(B) Items made in whole or in part of fabric in Federal Supply Group 83, Textile/leather/furs/apparel/findings/ tents/flags, or Federal Supply Group 84, Clothing, Individual Equipment and Insignia;

(C) Upholstered seats (whether for household, office, or other use); and

(D) Parachutes (Federal Supply Class 1670); or

(ii) The fibers and yarns are para-aramid fibers and yarns manufactured in the Netherlands.

(End of clause)

252.225-7031 SECONDARY ARAB BOYCOTT OF ISRAEL (JUN 1992)

(a) Definitions. As used in this clause--

(1) "Foreign person" means any person other than a United States person as defined in Section 16(2) of the Export Administration Act of 1979 (50 U.S.C. App. Sec 2415).

(2) "United States person" is defined in Section 16(2) of the Export Administration Act of 1979 and means any United States resident or national (other than an individual resident outside the United States and employed by other than a United States person), any domestic concern (including any permanent domestic establishment of any foreign concern), and any foreign subsidiary or affiliate (including any permanent foreign establishment) of any domestic concern which is controlled in fact by such domestic concerns, as determined under regulations of the President.

(b) Certification. By submitting this offer, the Offeror, if a foreign person, company or entity, certifies that it--

(1) Does not comply with the Secondary Arab Boycott of Israel; and

(2) Is not taking or knowingly agreeing to take any action, with respect to the Secondary Boycott of Israel by Arab countries, which 50 U.S.C. App. Sec 2407(a) prohibits a United States person from taking.

(End of clause)

252.227-7000 Non-estoppel. (OCT 1966)

The Government reserves the right at any time to contest the enforceability, validity, scope of, or the title to any patent or patent application herein licensed without waiving or forfeiting any right under this contract.

(End of clause)

252.227-7022 GOVERNMENT RIGHTS (UNLIMITED) (MAR 1979)

The Government shall have unlimited rights, in all drawings, designs, specifications, notes and other works developed in the performance of this contract, including the right to use same on any other Government design or construction without additional compensation to the Contractor. The Contractor hereby grants to the Government a paid-up license throughout the world to all such works to which he may assert or establish any claim under design patent or copyright laws. The Contractor for a period of three (3) years after completion of the project agrees to furnish the original or copies of all such works on the request of the Contracting Officer.

(End of clause)

252.227-7023 DRAWINGS AND OTHER DATA TO BECOME PROPERTY OF GOVERNMENT. (MAR 1979)

All designs, drawings, specifications, notes and other works developed in the performance of this contract shall become the sole property of the Government and may be used on any other design or construction without additional compensation to the Contractor. The Government shall be considered the "person for whom the work was prepared" for the purpose of authorship in any copyrightable work under 17 U.S.C. 201(b). With respect thereto, the Contractor agrees not to assert or authorize others to assert any rights nor establish any claim under the design patent or copyright laws. The Contractor for a period of three (3) years after completion of the project agrees to furnish all retained works on the request of the Contracting

Officer. Unless otherwise provided in this contract, the Contractor shall have the right to retain copies of all works beyond such period.

(End of clause)

252.227-7033 RIGHTS IN SHOP DRAWINGS (APR 1966)

(a) Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower-tier subcontractor pursuant to a construction contract, showing in detail (i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(b) This clause, including this paragraph (b), shall be included in all subcontracts hereunder at any tier.

252.231-7000 SUPPLEMENTAL COST PRINCIPLES (DEC 1991)

When the allowability of costs under this contract is determined in accordance with part 31 of the Federal Acquisition Regulation (FAR), allowability shall also be determined in accordance with part 231 of the Defense FAR Supplement, in effect on the date of this contract.

(End of clause)

252.236-7000 MODIFICATION PROPOSALS - PRICE BREAKDOWN. (DEC 1991)

(a) The Contractor shall furnish a price breakdown, itemized as required and within the time specified by the Contracting Officer, with any proposal for a contract modification.

(b) The price breakdown --

(1) Must include sufficient detail to permit an analysis of profit, and of all costs for --

(i) Material;

(ii) Labor;

(iii) Equipment;

(iv) Subcontracts; and

(v) Overhead; and

(2) Must cover all work involved in the modification, whether the work was deleted, added, or changed.

(c) The Contractor shall provide similar price breakdowns to support any amounts claimed for subcontracts.

(d) The Contractor's proposal shall include a justification for any time extension proposed.

252.236-7008 CONTRACT PRICES - BIDDING SCHEDULES. (DEC 1991)

(a) The Government's payment for the items listed in the Bidding Schedule shall constitute full compensation to the Contractor for --

(1) Furnishing all plant, labor, equipment, appliances, and materials; and

(2) Performing all operations required to complete the work in conformity with the drawings and specifications.

(b) The Contractor shall include in the prices for the items listed in the Bidding Schedule all costs for work in the specifications, whether or not specifically listed in the Bidding Schedule.

252.242-7000 POSTAWARD CONFERENCE (DEC 1991)

The Contractor agrees to attend any postaward conference convened by the contracting activity or contract administration office in accordance with Federal Acquisition Regulation subpart 42.5.

(End of clause)

252.243-7001 PRICING OF CONTRACT MODIFICATIONS (DEC 1991)

When costs are a factor in any price adjustment under this contract, the contract cost principles and procedures in FAR part 31 and DFARS part 231, in effect on the date of this contract, apply.

252.243-7002 REQUESTS FOR EQUITABLE ADJUSTMENT (MAR 1998)

(a) The amount of any request for equitable adjustment to contract terms shall accurately reflect the contract adjustment for which the Contractor believes the Government is liable. The request shall include only costs for performing the change, and shall not include any costs that already have been reimbursed or that have been separately claimed. All indirect costs included in the request shall be properly allocable to the change in accordance with applicable acquisition regulations.

(b) In accordance with 10 U.S.C. 2410(a), any request for equitable adjustment to contract terms that exceeds the simplified acquisition threshold shall bear, at the time of submission, the following certificate executed by an individual authorized to certify the request on behalf of the Contractor:

I certify that the request is made in good faith, and that the supporting data are accurate and complete to the best of my knowledge and belief.

(Official's Name)

(Title)

(c) The certification in paragraph (b) of this clause requires full disclosure of all relevant facts, including--

(1) Cost or pricing data if required in accordance with subsection 15.403-4 of the Federal Acquisition Regulation (FAR); and

(2) Information other than cost or pricing data, in accordance with subsection 15.403-3 of the FAR, including actual cost data and data to support any estimated costs, even if cost or pricing data are not required.

(d) The certification requirement in paragraph (b) of this clause does not apply to----

- (1) Requests for routine contract payments; for example, requests for payment for accepted supplies and services, routine vouchers under a cost-reimbursement type contract, or progress payment invoices; or
- (2) Final adjustment under an incentive provision of the contract.

252.247-7024 NOTIFICATION OF TRANSPORTATION OF SUPPLIES BY SEA (MAR 2000)

(a) The Contractor has indicated by the response to the solicitation provision, Representation of Extent of Transportation by Sea, that it did not anticipate transporting by sea any supplies. If, however, after the award of this contract, the Contractor learns that supplies, as defined in the Transportation of Supplies by Sea clause of this contract, will be transported by sea, the Contractor --

(1) Shall notify the Contracting Officer of that fact; and

(2) Hereby agrees to comply with all the terms and conditions of the Transportation of Supplies by Sea clause of this contract.

(b) The Contractor shall include this clause, including this paragraph (b), revised as necessary to reflect the relationship of the contracting parties--

(1) In all subcontracts under this contract, if this contract is a construction contract; or

(2) If this contract is not a construction contract, in all subcontracts under this contract that are for--

(i) Noncommercial items; or

(ii) Commercial items that--

(A) The Contractor is reselling or distributing to the Government without adding value (generally, the Contractor does not add value to items that it subcontracts for f.o.b. destination shipment);

(B) Are shipped in direct support of U.S. military contingency operations, exercises, or forces deployed in humanitarian or peacekeeping operations; or

(C) Are commissary or exchange cargoes transported outside of the Defense Transportation System in accordance with 10 U.S.C. 2643.

(End of clause)

252.219-7009 Section 8(a) Direct Award

SECTION 8(a) DIRECT AWARD (JUN 1998)

(a) This contract is issued as a direct award between the contracting office and the 8(a) Contractor pursuant to the Memorandum of Understanding dated May 6, 1998, between the Small Business Administration (SBA) and the Department of Defense. Accordingly, the SBA is not a party to this contract. SBA does retain responsibility for 8(a) certification, for 8(a) eligibility determinations and related issues, and for providing counseling and assistance to the 8(a) Contractor under the 8(a) Program. The cognizant SBA district office is:

*[To be completed by the Contracting Officer
at the time of award]*

(b) The contracting office is responsible for administering the contract and for taking any action on behalf of the Government under the terms and conditions of the contract; provided that the contracting office shall give advance notice to the SBA before it issues a final notice terminating performance, either in whole or in part, under the contract. The contracting office also shall coordinate with the SBA prior to processing any novation agreement. The contracting office may assign contract administration functions to a contract administration office.

(c) The Contractor agrees that—

(1) It will notify the Contracting Officer, simultaneous with its notification to the SBA (as required by SBA's 8(a) regulations at 13 CFR 124.308), when the owner or owners upon whom 8(a) eligibility is based plan to relinquish ownership or control of the concern. Consistent with Section 407 of Pub. L. 100-656, transfer of ownership or control shall result in termination of the contract for convenience, unless the SBA waives the requirement for termination prior to the actual relinquishing of ownership and control; and

(2) It will not subcontract the performance of any of the requirements of this contract without the prior written approval of the SBA and the Contracting Officer.

(End of clause)

252.247-7024 Notification of Transportation of Supplies by Sea (MAR 2000)

(a) The Contractor has indicated by the response to the solicitation provision, Representation of Extent of Transportation by Sea, that it did not anticipate transporting by sea any supplies. If, however, after the award of this contract, the Contractor learns that supplies, as defined in the Transportation of Supplies by Sea clause of this contract, will be transported by sea, the Contractor --

(1) Shall notify the Contracting Officer of that fact; and

(2) Hereby agrees to comply with all the terms and conditions of the Transportation of Supplies by Sea clause of this contract.

(b) The Contractor shall include this clause; including this paragraph (b), revised as necessary to reflect the relationship of the contracting parties--

(1) In all subcontracts under this contract, if this contract is a construction contract; or

(2) If this contract is not a construction contract, in all subcontracts under this contract that are for--

(i) Noncommercial items; or

(ii) Commercial items that--

(A) The Contractor is reselling or distributing to the Government without adding value (generally, the Contractor does not add value to items that it subcontracts for f.o.b. destination shipment);

(B) Are shipped in direct support of U.S. military contingency operations, exercises, or forces deployed in humanitarian or peacekeeping operations; or

(C) Are commissary or exchange cargoes transported outside of the Defense Transportation System in accordance with 10 U.S.C. 2643.

(End of clause)

Section 00800**Special Contract Requirements**

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CLAUSES INCORPORATED BY FULL TEXT

52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within **10** calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than **240 calendar days after receipt of notice to proceed. No additional time for contract completion will be allowed when an option is exercised. The given contract completion time was formulated to include necessary to perform all option work.** The time stated for completion shall include final cleanup of the premises.

(End of clause)

52.211-12 LIQUIDATED DAMAGES--CONSTRUCTION (SEP 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of \$839.00 for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

(End of clause)

52.211-13 TIME EXTENSIONS (SEP 2000)

Time extensions for contract changes will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the contract completion date will be extended only for those specific elements related to the changed work and that the remaining contract completion dates for all other portions of the work will not be altered. The change order also may provide an equitable readjustment of liquidated damages under the new completion schedule.

(End of clause)

52.222-23 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
19.7%	6.9%

|

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, within 10 working days following award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the --

- (1) Name, address, and telephone number of the subcontractor;
- (2) Employer's identification number of the subcontractor;
- (3) Estimated dollar amount of the subcontract;
- (4) Estimated starting and completion dates of the subcontract; and
- (5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is [California Ft. Irwin, San Bernadino County].

(End of provision)

52.228-12 Prospective Subcontractor Requests for Bonds. (OCT 1995)

In accordance with Section 806(a)(3) of Pub. L. 102-190, as amended by Sections 2091 and 8105 of Pub. L. 103-355, upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

(End of clause)

52.228-14 IRREVOCABLE LETTER OF CREDIT (DEC 1999)

(a) "Irrevocable letter of credit" (ILC), as used in this clause, means a written commitment by a federally insured financial institution to pay all or part of a stated amount of money, until the expiration date of the letter, upon presentation by the Government (the beneficiary) of a written demand therefor. Neither the financial institution nor

the offeror/Contractor can revoke or condition the letter of credit.

(b) If the offeror intends to use an ILC in lieu of a bid bond, or to secure other types of bonds such as performance and payment bonds, the letter of credit and letter of confirmation formats in paragraphs (e) and (f) of this clause shall be used.

(c) The letter of credit shall be irrevocable, shall require presentation of no document other than a written demand and the ILC (including confirming letter, if any), shall be issued/confirmed by an acceptable federally insured financial institution as provided in paragraph (d) of this clause, and--

(1) If used as a bid guarantee, the ILC shall expire no earlier than 60 days after the close of the bid acceptance period;

(2) If used as an alternative to corporate or individual sureties as security for a performance or payment bond, the offeror/Contractor may submit an ILC with an initial expiration date estimated to cover the entire period for which financial security is required or may submit an ILC with an initial expiration date that is a minimum period of one year from the date of issuance. The ILC shall provide that, unless the issuer provides the beneficiary written notice of non-renewal at least 60 days in advance of the current expiration date, the ILC is automatically extended without amendment for one year from the expiration date, or any future expiration date, until the period of required coverage is completed and the Contracting Officer provides the financial institution with a written statement waiving the right to payment. The period of required coverage shall be:

(i) For contracts subject to the Miller Act, the later of--

(A) One year following the expected date of final payment;

(B) For performance bonds only, until completion of any warranty period; or

(C) For payment bonds only, until resolution of all claims filed against the payment bond during the one-year period following final payment.

(ii) For contracts not subject to the Miller Act, the later of--

(A) 90 days following final payment; or

(B) For performance bonds only, until completion of any warranty period.

(d) Only federally insured financial institutions rated investment grade or higher shall issue or confirm the ILC. The offeror/Contractor shall provide the Contracting Officer a credit rating that indicates the financial institution has the required rating(s) as of the date of issuance of the ILC. Unless the financial institution issuing the ILC had letter of credit business of less than \$25 million in the past year, ILCs over \$5 million must be confirmed by another acceptable financial institution that had letter of credit business of less than \$25 million in the past year.

(e) The following format shall be used by the issuing financial institution to create an ILC:

[Issuing Financial Institution's Letterhead or Name and Address]

Issue Date _____

IRREVOCABLE LETTER OF CREDIT NO. _____

Account party's name _____

Account party's address _____

For Solicitation No. _____ (for reference only)

TO: [U.S. Government agency]

[U.S. Government agency's address]

1. We hereby establish this irrevocable and transferable Letter of Credit in your favor for one or more drawings up to United States \$ _____. This Letter of Credit is payable at [issuing financial institution's and, if any, confirming financial institution's] office at [issuing financial institution's address and, if any, confirming financial institution's address] and expires with our close of business on _____, or any automatically extended expiration date.

2. We hereby undertake to honor your or the transferee's sight draft(s) drawn on the issuing or, if any, the confirming financial institution, for all or any part of this credit if presented with this Letter of Credit and confirmation, if any, at the office specified in paragraph 1 of this Letter of Credit on or before the expiration date or any automatically extended expiration date.

3. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this Letter of Credit that it is deemed to be automatically extended without amendment for one year from the expiration date hereof, or any future expiration date, unless at least 60 days prior to any expiration date, we notify you or the transferee by registered mail, or other receipted means of delivery, that we elect not to consider this Letter of Credit renewed for any such additional period. At the time we notify you, we also agree to notify the account party (and confirming financial institution, if any) by the same means of delivery.

4. This Letter of Credit is transferable. Transfers and assignments of proceeds are to be effected without charge to either the beneficiary or the transferee/assignee of proceeds. Such transfer or assignment shall be only at the written direction of the Government (the beneficiary) in a form satisfactory to the issuing financial institution and the confirming financial institution, if any.

5. This Letter of Credit is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ [state of confirming financial institution, if any, otherwise state of issuing financial institution].

6. If this credit expires during an interruption of business of this financial institution as described in Article 17 of the UCP, the financial institution specifically agrees to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

[Issuing financial institution]

(f) The following format shall be used by the financial institution to confirm an ILC:

[Confirming Financial Institution's Letterhead or Name and Address]

(Date) _____

Our Letter of Credit Advice Number _____

Beneficiary: _____ [U.S. Government agency]

Issuing Financial Institution: _____

Issuing Financial Institution's LC No.: _____

Gentlemen:

1. We hereby confirm the above indicated Letter of Credit, the original of which is attached, issued by _____ [name of issuing financial institution] for drawings of up to United States dollars _____/U.S. \$_____ and expiring with our close of business on _____ [the expiration date], or any automatically extended expiration date.

2. Draft(s) drawn under the Letter of Credit and this Confirmation are payable at our office located at _____.

3. We hereby undertake to honor sight draft(s) drawn under and presented with the Letter of Credit and this Confirmation at our offices as specified herein.

4. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this confirmation that it be deemed automatically extended without amendment for one year from the expiration date hereof, or any automatically extended expiration date, unless:

(a) At least 60 days prior to any such expiration date, we shall notify the Contracting Officer, or the transferee and the issuing financial institution, by registered mail or other receipted means of delivery, that we elect not to consider this confirmation extended for any such additional period; or

(b) The issuing financial institution shall have exercised its right to notify you or the transferee, the account party, and ourselves, of its election not to extend the expiration date of the Letter of Credit.

5. This confirmation is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ [state of confirming financial institution].

6. If this confirmation expires during an interruption of business of this financial institution as described in Article 17 of the UCP, we specifically agree to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

[Confirming financial institution]

(g) The following format shall be used by the Contracting Officer for a sight draft to draw on the Letter of Credit:

SIGHT DRAFT

[City, State]

(Date) _____

[Name and address of financial institution]

Pay to the order of _____ [Beneficiary Agency] _____ the sum of United States \$_____.
 This draft is drawn under Irrevocable Letter of Credit No. _____.

 [Beneficiary Agency]

By: _____

(End of clause)

52.228-15 Performance and Payment Bonds--Construction (JUL 2000)-

(a) Definitions. As used in this clause--

Original contract price means the award price of the contract; or, for requirements contracts, the price payable for the estimated total quantity; or, for indefinite-quantity contracts, the price payable for the specified minimum quantity. Original contract price does not include the price of any options, except those options exercised at the time of contract award.

(b) Amount of required bonds. Unless the resulting contract price is \$100,000 or less, the successful offeror shall furnish performance and payment bonds to the Contracting Officer as follows:

(1) Performance bonds (Standard Form 25). The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract price.

(2) Payment Bonds (Standard Form 25-A). The penal amount of payment bonds at the time of contract award shall be 100 percent of the original contract price.

(3) Additional bond protection. (i) The Government may require additional performance and payment bond protection if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.

(ii) The Government may secure the additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.

(c) Furnishing executed bonds. The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, within the time period specified in the Bid Guarantee provision of the solicitation, or otherwise specified by the Contracting Officer, but in any event, before starting work.

(d) Surety or other security for bonds. The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register or may be obtained from the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch, 401 14th Street, NW, 2nd Floor, West Wing, Washington, DC 20227.

(e) Notice of subcontractor waiver of protection (40 U.S.C. 270b(c)). Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the contract.

(End of clause)

52.236-4 PHYSICAL DATA (APR 1984)

Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

(a) The indications of physical conditions on the drawings and in the specifications are the result of site investigations by N/A.

(b) Weather conditions: The Contractor shall satisfy himself as to the hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from any U. S. Weather Bureau Office.

(c) Transportation facilities: The Contractor shall make his own investigation of the conditions of existing public and private roads and clearances, restrictions, bridge load limits and other limitations affecting transportation and ingress and egress at the job site. The unavailability of transportation facilities or limitations thereof shall not become the basis for claims against the Government or extensions of time for completion of the work.

(d) N/A.

(End of clause)

52.236-16 QUANTITY SURVEYS (APR 1984)

(a) Quantity surveys shall be conducted, and the data derived from these surveys shall be used in computing the quantities of work performed and the actual construction completed and in place.

(b) The Government shall conduct the original and final surveys and make the computations based on them. The Contractor shall conduct the surveys for any periods for which progress payments are requested and shall make the computations based on these surveys. All surveys conducted by the Contractor shall be conducted under the direction of a representative of the Contracting Officer, unless the Contracting Officer waives this requirement in a specific instance.

(c) Promptly upon completing a survey, the Contractor shall furnish the originals of all field notes and all other records relating to the survey or to the layout of the work to the Contracting Officer, who shall use them as necessary to determine the amount of progress payments. The Contractor shall retain copies of all such material furnished to the Contracting Officer.

(End of clause)

52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997)

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order",

"designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean "approved by," or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown," as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place," that is "furnished and installed".

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements, and (2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor.

(End of clause)

252.236-7001 CONTRACT DRAWINGS, MAPS, AND SPECIFICATIONS (AUG 2000)

(a) The Government will provide to the Contractor, without charge, one set of contract drawings and specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer.

(b) The Contractor shall--

- (1) Check all drawings furnished immediately upon receipt;
- (2) Compare all drawings and verify the figures before laying out the work;
- (3) Promptly notify the Contracting Officer of any discrepancies;
- (4) Be responsible for any errors that might have been avoided by complying with this paragraph (b); and

(5) Reproduce and print contract drawings and specifications as needed.

(c) In general--

(1) Large-scale drawings shall govern small-scale drawings; and

(2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work that are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified on the ATTACHMENTS:

(End of clause)

ATTACHMENTS

General Decision Number CA030037

General Decision Number CA030037

Superseded General Decision No. CA020037 State: California

Construction Type:

BUILDING

DREDGING

HEAVY

HIGHWAY

County(ies):

SAN BERNARDINO

BUILDING CONSTRUCTION PROJECTS; DREDGING PROJECTS (does not include hopper dredge work); HEAVY CONSTRUCTION PROJECTS (does not include water well drilling); HIGHWAY CONSTRUCTION PROJECTS

Modification Number Publication Date

0

06/13/2003

COUNTY(ies):

SAN BERNARDINO

ASBE0005B 08/05/2002

	Rates	Fringes
ASBESTOS WORKER/INSULATOR		
Includes the application of all insulating materials, protective coverings, coatings, & finishes to all types of mechanical systems	33.06	8.11

ASBE0005Z 01/01/2003

	Rates	Fringes
Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulating materials from mechanical systems, whether they contain asbestos or not		
HAZARDOUS MATERIAL HANDLER	15.75	2.55

BOIL0092F 10/01/2002

	Rates	Fringes
BOILERMAKER	31.96	13.30

BRCA0004U 05/01/2003

	Rates	Fringes
BRICKLAYER; MARBLE MASON	29.42	6.20

BRCA0018G 06/01/2002

	Rates	Fringes
TILE LAYERS	26.50	7.45
TILE FINISHERS	16.65	2.91
MARBLE FINISHER	19.90	3.56

BRCA0018K 12/01/2000

	Rates	Fringes
TERRAZZO WORKER	26.78	5.34
TERRAZZO FINISHER	20.53	5.34

CARP0002B 07/01/2001

	Rates	Fringes
DIVERS:		
Diver, wet	486.08 per day	5.61
Diver, stand-by	243.04 per day	5.61
Diver tender	235.04 per day	5.61

CARP0002Q 07/01/2002

	Rates	Fringes
Work on wood framed construction of single family residences, apartments or condominiums under 4 stories		
DRYWALL INSTALLERS	19.00	5.18
DRYWALL STOCKER/SCRAPPER	10.00	4.68
All other work		
DRYWALL INSTALLERS	29.00	6.68

DRYWALL STOCKER/SCRAPPER	10.00	4.68
<hr/>		
CARP0003E 07/01/2002		
	Rates	Fringes
Work on wood frame, tilt up or concrete block construction including but not limited to: shopping centers, stores, office buildings, fast food establishments, also including curb, gutter and sidewalks where the total cost of the project does not exceed seven and one-half million (\$7,500,000.00) dollars.		
CARPENTERS:		
Carpenter, cabinet installer, insulation installer, floor worker and acoustical installer	22.75	6.28
Shingler	22.88	6.28
Roof loader of shingles	15.42	6.28
Saw filer	22.83	6.28
Table power saw operator	22.85	6.28
Pneumatic nailer or power stapler	23.00	6.28
Fence builder	20.30	6.28
Millwright	23.25	6.28
Pile driver; Derrick barge; Bridge or dock carpenter; Cable splicer; Heavy framer; Rockslinger	22.88	6.28
Head rockslinger	22.98	6.28
Rock barge or scow	22.78	6.28
Scaffold builder	17.00	6.28
All other work:		
Carpenter, cabinet installer, insulation installer, floor worker and acoustical installer	29.00	6.68
Shingler	29.13	6.68
Roof loader of shingles	20.77	6.68
Saw filer	29.08	6.68
Table power saw operator	29.10	6.68
Pneumatic nailer or power stapler	29.25	6.68
Fence builder	24.79	6.68
Millwright	29.50	6.68
Pile driver; Derrick barge; Bridge or dock carpenter; Cable splicer; Heavy framer; Rockslinger	29.13	6.68
Rockslinger	29.13	6.68
Rock barge or scow	29.03	6.68
Scaffold builder	23.20	6.68
FOOTNOTE:		
Work of forming in the construction of open cut sewers or storm drains, on operations in which horizontal lagging is used in		

conjunction with steel H-Beams driven or placed in pre-drilled holes, for that portion of a lagged trench against which concrete is poured, namely, as a substitute for back forms (which work is performed by piledrivers): \$0.13 per hour additional.

 CARP0003H 08/01/2002

	Rates	Fringes
MODULAR FURNITURE INSTALLER	14.00	5.16
FULL WALL TECHNICIAN	20.14	5.16
MOBILE FILING SYSTEM INSTALLERS	13.10	4.66

 ELEC0011C 12/01/2001

	Rates	Fringes
COMMUNICATIONS AND SYSTEMS WORK:		
Installer	22.13	3% + 4.40
Technician	23.93	3% + 4.40

SCOPE OF WORK:

Installation, testing, service and maintenance of systems utilizing the transmission and/or transference of voice, sound, vision and digital for commercial, educational, security and entertainment purposes for the following: TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call systems, radio page, school intercom and sound, burglar alarms, fire alarm (see last paragraph below) and low voltage master clock systems in commercial buildings.

Communication Systems that transmit or receive information and/or control systems that are intrinsic to the above listed systems; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding all other data systems or multiple systems which include control function or power supply; excluding installation of raceway systems, conduit systems, line voltage work, and energy management systems. Does not cover work performed at China Lake Naval Ordnance Test Station.

Fire alarm work shall be performed at the current inside wireman total cost package.

 ELEC0477B 06/04/2002

	Rates	Fringes
Electrician	28.25	3%+10.75
Cable splicer	27.75	3%+10.75
Electrician, tunnel work	33.37	3%+10.75

ZONE PAY:

Zone A - 80 road miles from Post Office, 455 Orange Show Lane, San Bernardino, will be a free zone for all contractors

Zone B - Any work performed outside Zone A's 80 road miles, shall add \$8.00 per hour to the current wage scale.

 ELEC1245A 06/01/2002

	Rates	Fringes
LINE CONSTRUCTION		
Lineman; Cable splicer	33.16	4.5%+7.08
Equipment specialist (operates		

crawler tractors, commercial motor vehicles, backhoes, trenchers, cranes (50 tons and below), and overhead and underground distribution line equipment)	28.19	4.5%+6.80
Groundman	21.56	4.5%+6.80
Powderman	31.51	4.5%+6.84

ELEV0018A 09/15/2001

	Rates	Fringes
ELEVATOR MECHANIC	33.695	7.455

FOOTNOTE:

Vacation Pay: 8% with 5 or more years of service, 6% for 6 months to 5 years service. Paid Holidays: New Years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Friday after, and Christmas Day.

ENGI0012C 07/01/2002

	Rates	Fringes
POWER EQUIPMENT OPERATORS:		
GROUP 1	27.85	11.85
GROUP 2	28.63	11.85
GROUP 3	28.92	11.85
GROUP 4	30.21	11.85
GROUP 5	30.43	11.85
GROUP 6	30.54	11.85
GROUP 7	30.66	11.85
GROUP 8	30.83	11.85
GROUP 9	30.93	11.85
GROUP 10	30.96	11.85
GROUP 11	31.04	11.85
GROUP 12	31.16	11.85
GROUP 13	31.33	11.85
GROUP 14	31.43	11.85
GROUP 15	31.54	11.85
GROUP 16	31.66	11.85
GROUP 17	31.83	11.85
GROUP 18	31.93	11.85
GROUP 19	32.04	11.85
GROUP 20	32.16	11.85
GROUP 21	32.33	11.85
CRANES, PILEDRIVING & HOISTING EQUIPMENT:		
GROUP 1	29.00	11.85
GROUP 2	29.78	11.85
GROUP 3	30.07	11.85
GROUP 4	30.21	11.85
GROUP 5	30.43	11.35
GROUP 6	30.54	11.85
GROUP 7	30.66	11.35
GROUP 8	30.83	11.85
GROUP 9	31.00	11.85
GROUP 10	32.00	11.85
GROUP 11	33.00	11.85
GROUP 12	34.00	11.85
GROUP 13	35.00	11.80
TUNNEL WORK:		

GROUP 1	30.28	11.85
GROUP 2	30.57	11.85
GROUP 3	30.71	11.85
GROUP 4	30.93	11.85
GROUP 5	31.04	11.85
GROUP 6	31.16	11.85
GROUP 7	31.46	11.85

FOOTNOTES: Workers required to suit up and work in a hazardous material environment: \$1.00 per hour additional.

Combination mixer and compressor operator on gunite work shall be classified as a concrete mobile mixer operator.

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Bargeman; Brakeman; Compressor operator; Ditch Witch, with seat or similar type equipment; Elevator operator-inside; Engineer Oiler; Forklift operator (includes load, lull or similar types under 5 tons; Generator operator; Generator, pump or compressor plant operator; Pump operator; Signalman; Switchman

GROUP 2: Asphalt-rubber plant operator (nurse tank operator); Concrete mixer operator-skip type; Conveyor operator; Fireman; Forklift operator (includes load, lull or similar types over 5 tons; Hydrostatic pump operator; oiler crusher (asphalt or concrete plant); Petromat laydown machine; PJU side dump jack; Screening and conveyor machine operator (or similar types); Skiploader (wheel type up to 3/4 yd. without attachment); Tar pot fireman; Temporary heating plant operator; Trenching machine oiler

GROUP 3: Asphalt-rubber blend operator; Bobcat or similar type (side steer); Equipment greaser (rack); Ford Ferguson (with dragtype attachments); Helicopter radioman (ground); Stationary pipe wrapping and cleaning machine operator

GROUP 4: Asphalt plant fireman; Backhoe operator (mini-max or similar type); Boring machine operator; Boxman or mixerman (asphalt or concrete); Chip spreading machine operator; Concrete cleaning decontamination machine operator; Concrete Pump Operator (small portable); Drilling machine operator, small auger types (Texoma super economatic or similar types - Hughes 100 or 200 or similar types - drilling depth of 30' maximum); Equipment greaser (grease truck); Guard rail post driver operator; Highline cableway signalman; Horizontal Directional Drilling Machine; Hydra-hammer-aero stomper; Micro Tunneling (above ground tunnel); Power concrete curing machine operator; Power concrete saw operator; Power-driven jumbo form setter operator; Power sweeper operator; Roller operator (compacting); Screed operator (asphalt or concrete); Trenching machine operator (up to 6 ft.); Vacuum or much truck

GROUP 5: Articulating material hauler; Asphalt plant engineer; Batch plant operator; Bit sharpener; Concrete joint machine operator (canal and similar type); Concrete planer operator; Dandy digger; Deck engine operator; Derrickman (oilfield type); Drilling machine operator, bucket or auger types (Calweld 100 bucket or similar types - Watson 1000 auger or similar types - Texoma 330, 500 or 600 auger or similar types - drilling depth of 45' maximum); Drilling machine operator (including water wells); Hydrographic seeder machine operator (straw, pulp or seed), Jackson track maintainer, or similar type; Kalamazoo Switch tamper, or similar type; Machine tool operator; Maginnis internal full slab vibrator, Mechanical berm, curb or

gutter(concrete or asphalt); Mechanical finisher operator (concrete, Clary-Johnson-Bidwell or similar); Micro tunnel system (below ground); Pavement breaker operator (truck mounted); Road oil mixing machine operator; Roller operator (asphalt or finish), rubber-tired earth moving equipment (single engine, up to and including 25 yds. struck); Self-propelled tar pipelining machine operator; Skiploader operator (crawler and wheel type, over 3/4 yd. and up to and including 1-1/2 yds.); Slip form pump operator (power driven hydraulic lifting device for concrete forms); Tractor operator-bulldozer, tamper-scraper (single engine, up to 100 h.p. flywheel and similar types, up to and including D-5 and similar types); Tugger hoist operator (1 drum); Ultra high pressure waterjet cutting tool system operator; Vacuum blasting machine operator

GROUP 6: Asphalt or concrete spreading operator (tamping or finishing); Asphalt paving machine operator (Barber Greene or similar type); Asphalt-rubber distribution operator; Backhoe operator (up to and including 3/4 yd.), small ford, Case or similar; Cast-in-place pipe laying machine operator; Combination mixer and compressor operator (gunite work); Compactor operator (self-propelled); Concrete mixer operator (paving); Crushing plant operator; Drill Doctor; Drilling machine operator, Bucket or auger types (Calweld 150 bucket or similar types - Watson 1500, 2000 2500 auger or similar types - Texoma 700, 800 auger or similar types - drilling depth of 60' maximum); Elevating grader operator; Grade checker; Gradall operator; Grouting machine operator; Heavy-duty repairman; Heavy equipment robotics operator; Kalamazoo balliste regulator or similar type; Kolman belt loader and similar type; Le Tourneau blob compactor or similar type; Loader operator (Athey, Euclid, Sierra and similar types); Ozzie padder or similar types; P.C. slot saw; Pneumatic concrete placing machine operator (Hackley-Presswell or similar type); Pumpcrete gun operator; Rotary drill operator (excluding caisson type); Rubber-tired earth-moving equipment operator (single engine, caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds. up to and including 50 cu. yds. struck); Rubber-tired earth-moving equipment operator (multiple engine up to and including 25 yds. struck); Rubber-tired scraper operator (self-loading paddle wheel type-John Deere, 1040 and similar single unit); Self-propelled curb and gutter machine operator; Shuttle buggy; Skiploader operator (crawler and wheel type over 1-1/2 yds. up to and including 6-1/2 yds.); Soil remediation plant operator; Surface heaters and planer operator; Tractor compressor drill combination operator; Tractor operator (any type larger than D-5 - 100 flywheel h.p. and over, or similar-bulldozer, tamper, scraper and push tractor single engine); Tractor operator (boom attachments), Traveling pipe wrapping, cleaning and bending machine operator; Trenching machine operator (over 6 ft. depth capacity, manufacturer's rating); Ultra high pressure waterjet cutting tool system mechanic; Water pull (compaction) operator

GROUP 7: Drilling machine operator, Bucket or auger types (Calweld 200 B bucket or similar types-Watson 3000 or 5000 auger or similar types-Texoma 900 auger or similar types-drilling depth of 105' maximum); Dual drum mixer, dynamic compactor LDC350 (or similar types); Monorail locomotive operator (diesel, gas or electric); Motor patrol-blade operator (single

engine); Multiple engine tractor operator (Euclid and similar type-except Quad 9 cat.); Rubber-tired earth-moving equipment operator (single engine, over 50 yds. struck); Pneumatic pipe ramming tool and similar types; Prestressed wrapping machine operator; Rubber-tired earth-moving equipment operator (single engine, over 50 yds. struck); Rubber tired earth moving equipment operator (multiple engine, Euclid, caterpillar and similar over 25 yds. and up to 50 yds. struck), Tower crane repairman; Tractor loader operator (crawler and wheel type over 6-1/2 yds.); Woods mixer operator (and similar Pugmill equipment)

GROUP 8: Auto grader operator; Automatic slip form operator; Drilling machine operator, bucket or auger types (Calweld, auger 200 CA or similar types - Watson, auger 6000 or similar types - Hughes Super Duty, auger 200 or similar types - drilling depth of 175' maximum); Hoe ram or similar with compressor; Mass excavator operator less tha 750 cu. yards; Mechanical finishing machine operator; Mobile form traveler operator; Motor patrol operator (multi-engine); Pipe mobile machine operator; Rubber-tired earth-moving equipment operator (multiple engine, Euclid, Caterpillar and similar type, over 50 cu. yds. struck); Rubber-tired self-loading scraper operator (paddle-wheel-auger type self-loading - two (2) or more units)

GROUP 9: Rubber-tired earth-moving equipment operator operating equipment with push-pull system (single engine, up to and including 25 yds. struck)

GROUP 10: Canal liner operator; Canal trimmer operator; Remote-control earth-moving equipment operator (operating a second piece of equipment: \$1.00 per hour additional); Wheel excavator operator (over 750 cu. yds.)

GROUP 11: Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (single engine, Caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds. and up to and including 50 yds. struck); Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (multiple engine-up to and including 25 yds. struck)

GROUP 12: Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (single engine, over 50 yds. struck); Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (multiple engine, Euclid, Caterpillar and similar, over 25 yds. and up to 50 yds. struck)

GROUP 13: Rubber-tired earth-moving equipment operator, operating equipment with push-pull system (multiple engine, Euclid, Caterpillar and similar, over 50 cu. yds. struck); Tandem tractor operator (operating crawler type tractors in tandem - Quad 9 and similar type)

GROUP 14: Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - single engine, up to and including 25 yds. struck)

GROUP 15: Rotex concrete belt operator (or similar types); Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - single engine, Caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over

25 yds. and up to and including 50 cu. yds. struck); Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - multiple engine, up to and including 25 yds. struck)

GROUP 16: Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - single engine, over 50 yds. struck); Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps, and similar types in any combination, excluding compaction units - multiple engine, Euclid, Caterpillar and similar, over 25 yds. and up to 50 yds. struck)

GROUP 17: Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - multiple engine, Euclid, Caterpillar and similar type, over 50 cu. yds. struck)

GROUP 18: Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (single engine, up to and including 25 yds. struck)

GROUP 19: Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (single engine, Caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds. and up to and including 50 yds. struck); Rubber-tired earth-moving equipment operator, operating with the tandem push-pull system (multiple engine, up to and including 25 yds. struck)

GROUP 20: Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (single engine, over 50 yds. struck); Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (multiple engine, Euclid, Caterpillar and similar, over 25 yds. and up to 50 yds. struck)

GROUP 21: Concrete pump operator-truck mounted; Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (multiple engine, Euclid, Caterpillar and similar type, over 50 cu. yds. struck)

CRANES, PILEDIVING AND HOISTING EQUIPMENT CLASSIFICATIONS

GROUP 1: Engineer oiler; Fork lift operator (includes loed, lull or similar types)

GROUP 2: Truck crane oiler

GROUP 3: A-frame or winch truck operator; Ross carrier operator (jobsite)

GROUP 4: Bridge-type unloader and turntable operator; Helicopter hoist operator

GROUP 5: Hydraulic boom truck; Stinger crane (Austin-Western or similar type); Tugger hoist operator (1 drum)

GROUP 6: Bridge crane operator; Cretor crane operator; Hoist operator (Chicago boom and similar type); Lift mobile operator; Lift slab machine operator (Vagtborg and similar types); Material hoist and/or manlift operator; Polar gantry crane operator; Self Climbing scaffold (or similar type); Shovel, backhoe, dragline, clamshell operator (over 3/4 yd. and up to 5 cu. yds. mrc); Tugger hoist operator

GROUP 7: Pedestal crane operator; Shovel, backhoe, dragline, clamshell operator (over 5 cu. yds. mrc); Tower crane repair; Tugger hoist operator (3 drum)

GROUP 8: Crane operator (up to and including 25 ton capacity); Crawler transporter operator; Derrick barge operator (up to and including 25 ton capacity); Hoist operator, stiff legs, Guy derrick or similar type (up to and including 25 ton capacity); Shovel, backhoe, dragline, clamshell operator (over 7 cu. yds., M.R.C.)

GROUP 9: Crane operator (over 25 tons and up to and including 50 tons mrc); Derrick barge operator (over 25 tons up to and including 50 tons mrc); Highline cableway operator; Hoist operator, stiff legs, Guy derrick or similar type (over 25 tons up to and including 50 tons mrc); K-crane operator; Polar crane operator; Self erecting tower crane operator maximum lifting capacity ten tons

GROUP 10: Crane operator (over 50 tons and up to and including 100 tons mrc); Derrick barge operator (over 50 tons up to and including 100 tons mrc); Hoist operator, stiff legs, Guy derrick or similar type (over 50 tons up to and including 100 tons mrc), Mobile tower crane operator (over 50 tons, up to and including 100 tons M.R.C.); Tower crane operator and tower gantry

GROUP 11: Crane operator (over 100 tons and up to and including 200 tons mrc); Derrick barge operator (over 100 tons up to and including 200 tons mrc); Hoist operator, stiff legs, Guy derrick or similar type (over 100 tons up to and including 200 tons mrc); Mobile tower crane operator (over 100 tons up to and including 200 tons mrc)

GROUP 12: Crane operator (over 200 tons up to and including 300 tons mrc); Derrick barge operator (over 200 tons up to and including 300 tons mrc); Hoist operator, stiff legs, Guy derrick or similar type (over 200 tons, up to and including 300 tons mrc); Mobile tower crane operator (over 200 tons, up to and including 300 tons mrc)

GROUP 13: Crane operator (over 300 tons); Derrick barge operator (over 300 tons); Helicopter pilot; Hoist operator, stiff legs, Guy derrick or similar type (over 300 tons); Mobile tower crane operator (over 300 tons)

TUNNEL CLASSIFICATIONS

GROUP 1: Skiploader (wheel type up to 3/4 yd. without attachment)

GROUP 2: Power-driven jumbo form setter operator

GROUP 3: Dinkey locomotive or motorperson (up to and including 10 tons)

GROUP 4: Bit sharpener; Equipment greaser (grease truck); Slip form pump operator (power-driven hydraulic lifting device for concrete forms); Tugger hoist operator (1 drum); Tunnel locomotive operator (over 10 and up to and including 30 tons)

GROUP 5: Backhoe operator (up to and including 3/4 yd.); Small Ford, Case or similar; Drill doctor; Grouting machine operator; Heading shield operator; Heavy-duty repairperson; Loader operator (Athey, Euclid, Sierra and similar types); Mucking machine operator (1/4 yd., rubber-tired, rail or track type); Pneumatic concrete placing machine operator (Hackley-Presswell or similar type); Pneumatic heading shield (tunnel); Pumpcrete gun operator; Tractor compressor drill combination operator; Tugger hoist operator (2 drum); Tunnel locomotive operator (over 30 tons)

GROUP 6: Heavy Duty Repairman

GROUP 7: Tunnel mole boring machine operator

ENGI0012D 08/01/2002

	Rates	Fringes
POWER EQUIPMENT OPERATORS:		
DREDGING:		
Leverman	34.65	11.85
Dredge dozer	31.18	11.85
Deckmate	31.07	11.85
Winch operator (stern winch on dredge)	30.52	11.85
Fireman; deckhand and bargeman	29.98	11.85
Barge mate	30.59	11.85

IRON0001R 07/01/2002		
	Rates	Fringes
IRONWORKERS:		
Fence erector	25.97	15.29
Ornamental, reinforcing and structural	26.86	15.29
FOOTNOTE: Work at China Lake Naval Test Station, Edwards Air Force Base, Fort Irwin Military Station, Fort Irwin Training Center-Goldstone, 29 Palms-Marine Corps, U.S. Marine Base-Barstow additional \$3.00 per hour.		
Work at Yermo Marine Corps Logistic Center additional \$2.00 per hour.		

LABO0001B 07/01/2002		
	Rates	Fringes
BRICK TENDER	21.10	9.57

LABO0002H 07/01/2002		
	Rates	Fringes
LABORERS:		
GROUP 1	20.10	9.98
GROUP 2	20.65	9.98
GROUP 3	21.20	9.98
GROUP 4	22.75	9.98
GROUP 5	23.10	9.98
TUNNEL LABORERS:		
GROUP 1	23.01	9.98
GROUP 2	23.33	9.98
GROUP 3	23.79	9.98
GROUP 4	24.48	9.98
GUNITE LABORERS:		
GROUP 1	22.84	12.73
GROUP 2	21.89	12.73
GROUP 3	18.35	12.73
FOOTNOTE: GUNITE PREMIUM PAY:		
Workers working from a Bosn'n's Chair or suspended from a rope or cable shall receive 40 cents per hour above the foregoing applicable classification rates.		
Workers doing gunite and/or shotcrete work in a tunnel shall receive 35 cents per hour above the foregoing applicable classification rates, paid on a portal-to-portal basis.		
Any work performed on, in or above any smoke stack, silo, storage elevator or similar type of structure, when such structure is in excess of 75'-0" above base level and which work must be performed in whole or in part more than 75'-0"		

above base level, that work performed above the 75'-0" level shall be compensated for at 35 cents per hour above the applicable classification wage rate.

LABORER CLASSIFICATIONS

GROUP 1: Cleaning and handling of panel forms; Concrete screeding for rough strike-off; Concrete, water curing; Demolition laborer, the cleaning of brick if performed by a worker performing any other phase of demolition work, and the cleaning of lumber; Fire watcher, limber, brush loader, piler and debris handler; Flag person; Gas, oil and/or water pipeline laborer; Laborer, asphalt-rubber material loader; Laborer, general or construction; Laborer, general clean-up; Laborer, landscaping; Laborer, jetting; Laborer, temporary water and air lines; Material hose operator (walls, slabs, floors and decks); Plugging, filling of shee bolt holes; Dry packing of concrete; Railroad maintenance, repair track person and road beds; Streetcar and railroad construction track laborers; Rigging and signaling; Scaler; Slip form raiser; Tar and mortar; Tool crib or tool house laborer; Traffic control by any method; Window cleaner; Wire mesh pulling - all concrete pouring operations

GROUP 2: Asphalt shoveler; Cement dumper (on 1 yd. or larger mixer and handling bulk cement); Cesspool digger and installer; Chucktender; Chute handler, pouring concrete, the handling of the chute from readymix trucks, such as walls, slabs, decks, floors, foundation, footings, curbs, gutters and sidewalks; Concrete curer, impervious membrane and form oiler; Cutting torch operator (demolition); Fine grader, highways and street paving, airport, runways and similar type heavy construction; Gas, oil and/or water pipeline wrapper - pot tender and form person; Guinea chaser; Headerboard person - asphalt; Laborer, packing rod steel and pans; Membrane vapor barrier installer; Power broom sweeper (small); Riprap stonepaver, placing stone or wet sacked concrete; Roto scraper and tiller; Sandblaster (pot tender); Septic tank digger and installer(lead); Tank scaler and cleaner; Tree climber, faller, chain saw operator, Pittsburgh chipper and similar type brush shredder; Underground laborer, including caisson bellow

GROUP 3: Buggymobile person; Concrete cutting torch; Concrete pile cutter; Driller, jackhammer, 2-1/2 ft. drill steel or longer; Dri-pak-it machine; Gas, oil and/or water pipeline wrapper, 6-in. pipe and over, by any method, inside and out; High scaler (including drilling of same); Hydro seeder and similar type; Impact wrench multi-plate; Kettle person, pot person and workers applying asphalt, lay-kold, creosote, lime caustic and similar type materials ("applying" means applying, dipping, brushing or handling of such materials for pipe wrapping and waterproofing); Operator of pneumatic, gas, electric tools, vibrating machine, pavement breaker, air blasting, come-alongs, and similar mechanical tools not separately classified herein; Pipelayer's backup person, coating, grouting, making of joints, sealing, caulking, diapering and including rubber gasket joints, pointing and any and all other services; Rock slinger; Rotary scarifier or multiple head concrete chipping scarifier; Steel headerboard and guideline setter; Tamper, Barko, Wacker and similar type; Trenching machine, hand-propelled

GROUP 4: Asphalt raker, lute person, ironer, asphalt dump person, and asphalt spreader boxes (all types); Concrete core

cutter (walls, floors or ceilings), grinder or sander; Concrete saw person, cutting walls or flat work, scoring old or new concrete; Cribber, shorer, lagging, sheeting and trench bracing, hand-guided lagging hammer; Head rock slinger; Laborer, asphalt-rubber distributor boot person; Laser beam in connection with laborers' work; Oversize concrete vibrator operator, 70 lbs. and over; Pipelayer performing all services in the laying and installation of pipe from the point of receiving pipe in the ditch until completion of operation, including any and all forms of tubular material, whether pipe, metallic or non-metallic, conduit and any other stationary type of tubular device used for the conveying of any substance or element, whether water, sewage, solid gas, air, or other product whatsoever and without regard to the nature of material from which the tubular material is fabricated; No-joint pipe and stripping of same; Prefabricated manhole installer; Sandblaster (nozzle person), water blasting, Porta Shot-Blast

GROUP 5: Blaster powder, all work of loading holes, placing and blasting of all powder and explosives of whatever type, regardless of method used for such loading and placing; Driller: All power drills, excluding jackhammer, whether core, diamond, wagon, track, multiple unit, and any and all other types of mechanical drills without regard to the form of motive power; Toxic waste removal

TUNNEL LABORER CLASSIFICATIONS

GROUP 1: Batch plant laborer; Bull gang mucker, track person; Changehouse person; Concrete crew, including rodder and spreader; Dump person; Dump person (outside); Swamper (brake person and switch person on tunnel work); Tunnel materials handling person

GROUP 2: Chucktender, cabletender; Loading and unloading agitator cars; Nipper; Pot tender, using mastic or other materials (for example, but not by way of limitation, shotcrete, etc.); Vibrator person, jack hammer, pneumatic tools (except driller)

GROUP 3: Blaster, driller, powder person; Chemical grout jet person; Cherry picker person; Grout gun person; Grout mixer person; Grout pump person; Jackleg miner; Jumbo person; Kemper and other pneumatic concrete placer operator; Miner, tunnel (hand or machine); Nozzle person; Operating of troweling and/or grouting machines; Powder person (primer house); Primer person; Sandblaster; Shotcrete person; Steel form raiser and setter; Timber person, retimber person, wood or steel; Tunnel Concrete finisher

GROUP 4: Diamond driller; Sandblaster; Shaft and raise work

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Nozzle person and rod person

GROUP 2: Gun person

GROUP 3: Rebound person

LABO0783D 08/07/2002	Rates	Fringes
Fort Irwin, George Air Force Base, Marine Corps Air Station 29 Palms, Marine Corps Logistics Supply Base:		
PLASTERER TENDER	26.00	10.17
PLASTER CLEANUP LABORER	23.45	10.17
Remainder of San Bernardino County:		

PLASTERER TENDER	23.00	10.17
PLASTER CLEANUP LABORER	20.45	10.17

LABO0882B 01/01/2002		
	Rates	Fringes
ASBESTOS REMOVAL LABORER	20.97	7.65
SCOPE OF WORK: Includes site mobilization, initial site cleanup, site preparation, removal of asbestos-containing material and toxic waste, encapsulation, enclosure and disposal of asbestos-containing materials and toxic waste by hand or with equipment or machinery; scaffolding, fabrication of temporary wooden barriers and assembly of decontamination stations.		

LABO1184A 07/01/2002		
	Rates	Fringes
LABORERS - STRIPING:		
GROUP 1	20.65	8.42
GROUP 2	21.50	8.42
GROUP 3	23.82	8.42
GROUP 4	26.02	8.42
LABORERS - STRIPING CLASSIFICATIONS		
GROUP 1: Protective coating, pavement sealing, including repair and filling of cracks by any method on any surface in parking lots, game courts and playgrounds; carstops; operation of all related machinery and equipment; equipment repair technician		
GROUP 2: Traffic surface abrasive blaster; pot tender - removal of all traffic lines and markings by any method (sandblasting, waterblasting, grinding, etc.) and preparation of surface for coatings. Traffic control person: controlling and directing traffic through both conventional and moving lane closures; operation of all related machinery and equipment		
GROUP 3: Traffic delineating device applicator: Layout and application of pavement markers, delineating signs, rumble and traffic bars, adhesives, guide markers, other traffic delineating devices including traffic control. This category includes all traffic related surface preparation (sandblasting, waterblasting, grinding) as part of the application process. Traffic protective delineating system installer: removes, relocates, installs, permanently affixed roadside and parking delineation barricades, fencing, cable anchor, guard rail, reference signs, monument markers; operation of all related machinery and equipment; power broom sweeper		
GROUP 4: Striper: layout and application of traffic stripes and markings; hot thermo plastic; tape traffic stripes and markings, including traffic control; operation of all related machinery and equipment		

LABO1184E 07/01/2002		
	Rates	Fringes
SLURRY SEAL WORK		
LABORERS:		
Group 1	21.66	8.42
Group 2	22.86	8.42
Group 3	24.72	8.42
Group 4	26.32	8.42
GROUP 1 - Traffic Control Person & Serviceman; including work of installing and protecting utility covers, traffic		

delineating devices, posting of no parking and notifications for public convenience, surface cleaning by any method, repair and filing of cracks by any means, and other work not directly connected with the application of slurry seal.

GROUP 2 - Squeegeeman (finish); Traffic control person.

GROUP 3 - Applicator operator (line driver); Power broom sweeper operator; Operation of all related machinery and equipment; Shuttleman

GROUP 4 - Mix operator

PAIN0036A 07/01/2002		
	Rates	Fringes
Work on service stations and and car washes; Small new commercial work (defined as construction up to and including 3 stories in height, such as small shopping centers, small stores, small office buildings and small food establishments); Small new industrial work (defined as light metal buildings, small warehouses, small storage facilities and tilt-up buildings); Repaint work (defined as repaint of breweries, commercial recreational facilities, hotels which operate commercial establishments as part of hotel service, and sports facilities); Tenant improvement work (defined as tenant improvement work not included in conjunction with the construction of the building, and all repainting of tenant improvement projects		
PAINTER (including lead abatement)	21.75	5.89
All other work:		
PAINTER	25.02	5.89

PAIN0036H 10/01/2002		
	Rates	Fringes
DRYWALL FINISHERS	26.33	8.48

PAIN0036R 06/01/2002		
	Rates	Fringes
GLAZIERS	29.20	8.45
FOOTNOTE: Additional \$1.25 per hour for work in a condo, from the third (3rd) floor and up Additional \$1.25 per hour for work on the outside of the building from a swing state or any suspended contrivance, from the ground up		

PAIN1247B 01/01/2003		
	Rates	Fringes
SOFT FLOOR LAYER	26.70	6.25

PLAS0200H 08/07/2002		
	Rates	Fringes
FORT IRWIN; GEORGE AIR FORCE BASE; MAARINE CORPS AIR STATION 29 PALM,; AND MARINE CORPS LOGISTICS SUPPLY BASE:		
PLASTERERS	29.77	6.76
REMAINDER OF COUNTY: PLASTERERS	26.77	6.76

PLAS0500B 07/01/2002		
	Rates	Fringes
CEMENT MASON	23.05	11.56

PLUM0016B 07/01/2002		
	Rates	Fringes
PLUMBER; STEAMFITTER: Work on strip malls, light commercial, tenant improvement and remodel work	23.03	8.24
Work on new additions and remodeling of bars, restaurants, stores and commercial buildings, not to exceed 5,000 sq. ft. of floor space	28.92	9.44
All other work: Fort Irwin Army Base, Marine Corps Logistic Base at Nebo, Marine Corps Logistic Base at Yermo and Twenty-Nine Palms Marine Base	33.31	10.01
George Air Force Base	32.06	10.01
Remainder of County	29.81	10.01
SEWER AND STORM DRAIN WORK	20.25	9.75

PLUM0345A 07/01/2002		
	Rates	Fringes
LANDSCAPE & IRRIGATION FITTER	23.27	9.56

ROOF0036B 09/01/2001		
	Rates	Fringes
ROOFER	24.77	5.40
Duties limited to the following: Roof removal of any type of roofing or roofing material; or spudding, or sweeping; and/or clean-up; and/or preload in, or in preparing the roof for application of roofing, damp and/or waterproofing materials		

PREPARER 16.24 1.00
 FOOTNOTE: Pitch premium: Work on which employees are exposed to pitch fumes or required to handle pitch, pitch base or pitch impregnated products, or any material containing coal tar pitch, the entire roofing crew shall receive \$1.75 per hour "pitch premium" pay.

 SFCA0669I 01/01/2003

	Rates	Fringes
DOES NOT INCLUDE THE NORTHERN PART OF THE CITY OF CHINO, OR THE CITIES OF MONTCLAIR OR ONTARIO:		
SPRINKLER FITTER (FIRE)	26.75	9.60

 SFCA0709D 09/01/2002

	Rates	Fringes
THE NORTHERN PART OF THE CITY OF CHINO, AND THE CITIES OF MONTCLAIR AND ONTARIO:		
SPRINKLER FITTER (FIRE)	36.18	11.50

 SHEE0102G 07/01/2002

	Rates	Fringes
INDUSTRIAL		
Work on all air pollution control systems, noise abatement panels, blow pipe, air-veyor systems, dust collecting, baghouses, heating, air conditioning, and ventilating (other than creature comfort) and all other industrial work, including metal insulated ceilings		
SHEETMETAL WORKER	26.07	15.00

 SHEE0102H 01/01/2003

	Rates	Fringes
COMMERCIAL:		
Work on all commercial HVAC for creature comfort and computer clean rooms, architectural metals, metal roofing and lagging, over insulation		
SHEET METAL WORKER	29.41	11.97

 TEAM0011I 07/01/2002

	Rates	Fringes
EDWARDS AFB, FORT IRWIN, GEORGE AFB, MARINE CORPS LOGISTIC BASE AT NEBO & YERMO, TWENTY-NINE PALMS BASE		
TRUCK DRIVERS:		
GROUP 1	24.84	12.84
GROUP 2	24.99	12.84
GROUP 3	25.12	12.84
GROUP 4	25.31	12.84
GROUP 5	25.25	12.84
GROUP 6	25.37	12.84
GROUP 7	25.62	12.84
GROUP 8	25.87	12.84
GROUP 9	26.02	12.84

GROUP 10	26.37	12.84
GROUP 11	26.87	12.84
REMAINDER OF COUNTY:		
GROUP 1	21.84	12.84
GROUP 2	21.99	12.84
GROUP 3	22.12	12.84
GROUP 4	22.31	12.84
GROUP 5	22.25	12.84
GROUP 6	22.37	12.84
GROUP 7	22.62	12.84
GROUP 8	22.87	12.84
GROUP 9	23.02	12.84
GROUP 10	23.37	12.84
GROUP 11	23.87	12.84

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Truck driver

GROUP 2: Driver of vehicle or combination of vehicles - 2 axles; Traffic control pilot car excluding moving heavy equipment permit load; Truck-mounted broom

GROUP 3: Driver of vehicle or combination of vehicles - 3 axles; Boot person; Cement mason distribution truck; Fuel truck driver; Water truck - 2 axle; Dump truck, less than 16 yds. water level; Erosion control driver

GROUP 4: Driver of transit mix truck, under 3 yds.; Dumpcrete truck, less than 6-1/2 yds. water level

GROUP 5: Water truck, 3 or more axles; Truck greaser and tire person (\$0.50 additional for tire person); Pipeline and utility working truck driver, including winch truck and plastic fusion, limited to pipeline and utility work; Slurry truck driver

GROUP 6: Transit mix truck, 3 yds. or more; Dumpcrete truck, 6-1/2 yds. water level and over; Vehicle or combination of vehicles - 4 or more axle; Oil spreader truck; Dump truck, 16 yds. to 25 yds. water level

GROUP 7: A Frame, Swedish crane or similar; Forklift driver; Ross carrier driver

GROUP 8: Dump truck, 25 yds. or more water level; Truck repair person; Water pull - single engine; Welder

GROUP 9: Truck repair person/welder; Low bed driver, 9 axles or over

GROUP 10: Dump truck - 50 yds. or more water level; Water pull - single engine with attachment

GROUP 11: Water pull - twin engine; Water pull - twin engine with attachments; Winch truck driver - \$1.25 additional when operating winch or similar special attachments

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(ii)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be

prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

PREAWARD SURVEY OF PROSPECTIVE CONTRACTORS
CONSTRUCTION CONTRACTS

It is the general policy of the Department of Defense that contracts shall be awarded only to contractors determined to be responsible in accordance with Part 9 of the Federal Acquisition Regulation (FAR).

No contract shall be awarded to any person or firm unless the Contracting Officer first makes an affirmative determination that the prospective contractor is responsible within the meaning of the FAR, Part 9.

Before making a determination of responsibility, the Contracting Officer shall have in his/her possession or obtain information sufficient to satisfy himself/herself that a prospective contractor currently meets the minimum FAR Part 9 standards.

In order to make the required determination and also to expedite the contract award, the following information must be submitted by the Contractor as directed (see Section 00100, SAACONS 52.0209-4501):

- A. COMPLETED CONTRACTOR EXPERIENCE DATA FORM WITH SUPPLEMENTAL SCHEDULES A-D (ATTACHED).
- B. LATEST FINANCIAL STATEMENTS. IF THE FINANCIAL STATEMENT IS MORE THAN 60 DAYS OLD, SUBMIT A CERTIFICATE STATING THAT THE FIRM'S FINANCIAL CONDITION IS SUBSTANTIALLY THE SAME, OR, IF NOT THE SAME, STATE THE CHANGES THAT HAVE TAKEN PLACE.
- C. PROVIDE LETTERS FROM BANKS OR OTHER FINANCIAL INSTITUTIONS WITH WHICH THE CONTRACTOR CONDUCTS BUSINESS. THE LETTERS SHOULD CONTAIN INFORMATION ABOUT YOUR FIRM'S ACCOUNTS, LOANS, LINES OF CREDIT, ETC., PROVIDING INFORMATION LEADING TO A DETERMINATION THAT YOUR FIRM IS "RESPONSIBLE" AS DEFINED IN THE FEDERAL ACQUISITION REGULATION, PART 9, "HAS THE FINANCIAL RESOURCES TO PERFORM THE CONTRACT OR THE ABILITY TO OBTAIN THEM". THE GOVT IS INTERESTED IN FINANCIAL STABILITY, TIMELY PAYMENTS, THE LENGTH AND NATURE OF THE RELATIONSHIP BETWEEN THE FIRM AND THE FINANCIAL INSTITUTION, ETC. WHICH REVEALS THE FIRM'S FINANCIAL ABILITY TO PERFORM THE CONTRACT. THE LETTERS SHOULD ALSO PROVIDE THE NAME AND TELEPHONE NUMBER OF THE BANK REPRESENTATIVE THE GOVERNMENT MAY CONTACT.

BE SURE TO INCLUDE IN YOUR PREAWARD SURVEY, INFORMATION ON ANY CONTRACTS YOU HAVE HAD WITH THE SACRAMENTO DISTRICT OR LOS ANGELES DISTRICT, CORPS OF ENGINEERS, WITHIN THE LAST 12 MONTHS.

THESE DOCUMENTS SHALL BE TREATED BY THE GOVERNMENT AS CONFIDENTIAL.

CONSTRUCTION CONTRACTOR EXPERIENCE DATA		DATE:	
Firm Name and Telephone Number		Main Office Address (Street, City, and State)	
Branch Offices		Services Rendered Construction Design Consultant	
Organization Individual Partnership	Joint Venture Corporation	Date Organized	Date Incorporated: State:
Names of Officers and Other Key Personnel			
I – PRESENT PAYROLL PERSONNEL (List Number of Each Category Below)			
Partners:	Remainder:	Subtotal Permanent:	
Officers:	Total:	Maximum Personnel at Any Time:	
Other Key:		Date:	
II—EQUIPMENT OWNED		III—FINANCIAL DATA AS OF (DATE):	
Present Value (\$)		Current Assets:	
Acquisition Cost (\$)		Current Liabilities:	
		Net Worth:	
IV—TOTAL VALUE OF CONSTRUCTION AND DEMOLITION WORK IN PAST 6 YRS EXCLUSIVE OF JOINT VENTURE (LIST MOST RECENT FIRST)		V—LARGEST JOB EVER CONTRACTED (If Other Than in Past Six Years)	
\$	LARGEST JOB IN PAST 6 YRS		Contract Amount:
\$	Contract Amount:		Date:
\$	Date:		Description:
\$	Description:		
\$			
\$			
Avg. Annual Income	Owner:		Owner:
\$			
VI—TYPE OF WORK IN WHICH FIRM SPECIALIZES			
NAME AND POSITION/TITLE OF PERSON SIGNING		SIGNATURE	
NOTE: Use reverse side for explanations or detailed description of item(s) reported above.			

SCHEDULE A

CONSTRUCTION CONTRACTOR EXPERIENCE DATA

EXISTING COMMITMENTS: (List below the construction projects your firm has under way on this date, including those on which you are presently low bidder but have not received an award.)

CONTRACT NUMBER AND AMOUNT	DESCRIPTION OF WORK	FOR WHOM PERFORMED*	PERCENT COMPLETE	PERCENT SUBLET
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* PROVIDE NAME OF ORGANIZATION, POINT OF CONTACT AND TELEPHONE NUMBER FOR CONTACT.

SCHEDULE B

CONSTRUCTION CONTRACTOR EXPERIENCE DATA

EXPERIENCE DATA: (List below the principal construction projects your firm has completed within the past six (6) years.)

<u>CONTRACT NO.</u>	<u>AMOUNT</u>	<u>DESCRIPTION/LOCATION</u>	<u>CONTACT PERSON/PHONE NO</u>	<u>PERCENT SUBLET</u>
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SCHEDULE C

CONSTRUCTION CONTRACTOR EXPERIENCE DATA

CONSTRUCTION AND/OR TECHNICAL EQUIPMENT: (List total equipment and facilities owned for performing the work and present status as to whether or not it is committed to existing contracts.)

<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>CONDITION</u>	<u>YEARS OF SERVICE</u>	<u>PRESENT STATUS</u>
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SCHEDULE D

CONSTRUCTION CONTRACTOR EXPERIENCE DATA

TO BE COMPLETED IF PROPOSED MILITARY CONSTRUCTION CONTRACT EXCEEDS \$1,000,000.

A. Each contract awarded within the preceding three-month period exceeding \$1,000,000 in value with brief description of the contract:

B. Each contract awarded within the preceding three-year period not already physically completed and exceeding \$5,000,000 in value with brief description of the contract:

- S A M P L E -

SUBCONTRACTING PLAN

SUBCONTRACTING PLAN SUBMITTED IN ACCORDANCE WITH PUBLIC LAW 95-507 (THE FOLLOWING FORMAT IS ESTABLISHED IN ACCORDANCE WITH FAR 52.219-9(d)(1) THROUGH (d)(11) AND INCLUDES THE REQUIRED STATUTORY ELEMENTS AS DESCRIBED IN FAR 19.704. IT ALSO INCLUDES ADDITIONAL REQUIREMENTS OF THE DFARS 219.704 AND AFARS 5119.704. EVALUATION OF THE SUBCONTRACTING PLAN BY THE GOVERNMENT WILL BE AS PRESCRIBED IN FAR 19.705 (AND ITS SUPPLEMENTS).

DO NOT JUST ADDRESS THE FOLLOWING ISSUES IN SHORT; FOLLOW THE GUIDANCE OF FAR 52.219-9 IN ITS ENTIRETY. FOR EXAMPLE, PARAGRAPH 11 BELOW ASKS FOR A DISCUSSION OF RECORDS; THE PLAN SHOULD ADDRESS ALL RECORDS AS DESCRIBED IN FAR 52.219-9(d)(11)(i) THROUGH (vi).

IN ACCORDANCE WITH FAR 19.704 IF THE CONTRACT CONTAINS OPTIONS, THE CUMULATIVE VALUE OF THE BASIC CONTRACT AND ALL OPTIONS IS CONSIDERED IN DETERMINING WHETHER A SUBCONTRACTING PLAN IS NECESSARY. ONCE IT HAS BEEN DECIDED IF A PLAN IS NECESSARY, THE SUBCONTRACTING PLAN SHALL CONTAIN SEPARATE PARTS, ONE FOR THE BASIC CONTRACT AND ONE FOR EACH OPTION. IN OTHER WORDS, IT IS NECESSARY TO ADDRESS PLANNED SUBCONTRACTING DOLLARS AND PERCENTAGES OF TOTAL TO BE AWARDED TO SMALL, SMALL DISADVANTAGED, HUBZONE SMALL, WOMEN-OWNED SMALL, VETERAN-OWNED SMALL, SERVICE-DISABLED VETERAN-OWNED SMALL, HISPANIC SERVICING INSTITUTIONS AND TRIBAL COUNCIL UNIVERSITIES, HBCU/MIs, AND QUALIFIED NONPROFIT AGENCIES FOR THE BLIND AND OTHER SEVERELY DISABLED SEPARATELY FOR THE BASIC CONTRACT PERIOD AND EACH OPTION YEAR. THEREFORE, PARAGRAPHS 1 AND 2 BELOW MUST BE PREPARED SEPARATELY FOR THE BASE YEAR AND EACH OPTION YEAR. ALL OTHER PARTS OF THE SUBCONTRACTING PLAN ONLY NEED TO BE ADDRESSED ONCE.

IF THE SUBCONTRACTING PLAN'S PROPOSED SUBCONTRACTING GOALS DO NOT MEET THE CORPS OF ENGINEERS' SUBCONTRACTING GOALS, THE SUBCONTRACTING PLAN MUST BE SUBMITTED WITH A FULL EXPLANATION OF THE REASONS FOR THE LESSER GOALS ESTABLISHED BY THE PLAN. A SMALL DISADVANTAGED BUSINESS GOAL OF LESS THAN FIVE PERCENT MUST BE APPROVED TWO LEVELS ABOVE THE CONTRACTING OFFICER (DFARS 219.705-4).

PROJECT TITLE: _____

RFP/IFB NO.: _____ CONTRACT NO.: _____

CONTRACTOR NAME: _____

DIVISION: _____

INDIVIDUAL COMPLETING THIS PLAN: _____

TELEPHONE NO.: _____

1. Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small businesses, small disadvantaged businesses, HUBZone small businesses, women-owned small businesses, veteran-owned small businesses, service-disabled veteran-owned small businesses as subcontractors. The offeror shall include all subcontracts that contribute to contract performance and may include a proportionate share of products and services that are normally allocated as indirect costs.

Percentage Goals:		Corps of Engineers Subcontracting Goals
Small Business	_____ %	57.2%
Small Disadvantaged Business	_____ %	8.9%
Women-Owned Small Business	_____ %	8.1%
HUBZone Small Business	_____ %	3.0%
Service-Disabled Veteran-Owned Small Business	_____ %	3.0%

2. Statement of: (i) total dollars planned to be subcontracted, (ii) total dollars planned to be subcontracted to small business; (iii) total dollars planned to be subcontracted to veteran-owned small business; (iv) total dollars planned to be subcontracted to HUBZone small business; (v) total dollars planned to be subcontracted to small disadvantaged business; and (vi) total dollars planned to be subcontracted to women-owned small business.

Total Cost of Prime Contract:	\$ _____	
Total Dollars to be Subcontracted	\$ _____	_____ % *
To Small Business	\$ _____	_____ % **
To Small Disadvantaged Business	\$ _____	_____ % **
To Women-Owned Small Business	\$ _____	_____ % **
To HUBZone Small Business	\$ _____	_____ % **
To Service-Disabled Veteran-owned Small Business	\$ _____	_____ % **

NOTES: * Calculate percentage of Total Dollars to be Subcontracted to Total Cost of Prime Contract

** Calculate subcontracted dollars to each group to Total Dollars to be Subcontracted, NOT TO Total Cost of Prime Contract.

PLANNED SUBCONTRACTING INCLUDES ALL PLANNED EXPENDITURES. TOTAL ESTIMATED COST TO SUBCONTRACTORS AND GOALS MUST BE ESTABLISHED EVEN IF THE CONTRACT IS OF THE INDEFINITE-DELIVERY TYPE.

SUBCONTRACTS AWARDED TO SMALL DISADVANTAGED BUSINESSES, HUBZONE SMALL BUSINESSES, WOMEN-OWNED SMALL BUSINESSES, VETERAN-OWNED SMALL BUSINESSES, SERVICE-DISABLED VETERAN-OWNED SMALL BUSINESSES, HISPANIC SERVICING INSTITUTIONS, AND TRIBAL COUNCIL UNIVERSITIES, HBCU/MIs, AND QUALIFIED NONPROFIT AGENCIES FOR THE BLIND AND OTHER SEVERELY DISABLED COUNT TOWARD THE OVERALL SMALL BUSINESS GOAL. HBCU/MIs ARE COUNTED AS A SUBSET OF THE SMALL DISADVANTAGED GOAL. THE CORPS OF ENGINEERS HAS NOT BEEN ASSIGNED A SET GOAL FOR HUBZONE SMALL BUSINESS, HISPANIC SERVICING INSTITUTION AND TRIBAL COUNCIL UNIVERSITIES, HBCU/MIs OR QUALIFIED NONPROFIT AGENCIES FOR THE BLIND AND OTHER SEVERELY DISABLED.

IN ACCORDANCE WITH DFARS 219.703, QUALIFIED NONPROFIT AGENCIES FOR THE BLIND AND OTHER SEVERELY DISABLED THAT HAVE BEEN APPROVED BY THE COMMITTEE FOR PURCHASE FROM PEOPLE WHO ARE BLIND OR SEVERELY DISABLED UNDER THE JAVITS-WAGNER-O'DAY (41 U.S.C. 46-48) ARE ELIGIBLE TO PARTICIPATE IN THE PROGRAM AS A RESULT OF 10 U.S.C. 2410d AND SECTION 9077 OF PUB. L. 102-396 AND SIMILAR SECTIONS IN SUBSEQUENT DEFENSE APPROPRIATIONS ACTS. UNDER THIS AUTHORITY SUBCONTRACTS AWARDED TO SUCH ENTITIES MAY BE COUNTED TOWARD THE PRIME CONTRACTOR'S SMALL BUSINESS SUBCONTRACTING GOAL.

3. A description of the principal types of supplies and services to be subcontracted and an identification of the types planned for subcontracting to (i) small business concerns, (ii) small disadvantaged business concerns, (iii) HUBZone small business concerns, (iv) women-owned small business concerns, (v) veteran-owned small business concerns (vi) service-disabled veteran-owned small business concerns, (vii) Hispanic Servicing Institutions, and Tribal Council Universities, (viii) HBCUs and MIs, (ix) qualified nonprofit agencies for the blind and other severely disabled.

4. A statement of the method used in developing the proposed subcontracting goals for small business concerns, small disadvantaged business concerns, HUBZone small business concerns, women-owned small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, Hispanic Servicing Institutions and Tribal Council Universities, HBCUs and MIs, and qualified nonprofit agencies for the blind and other severely disabled.

5. A description of the method used to identify potential sources for solicitation purposes to assure small, small disadvantaged, HUBZone small, women-owned small, veteran-owned small, service-disabled veteran-owned small, Hispanic Servicing Institutions and Tribal Council Universities, HBCU and MI, and qualified nonprofit agencies for the blind and other severely disabled participation (e.g., existing company source lists, the Procurement Marketing and Access Network (PRO-Net) of the Small Business Administration (SBA), the list of certified small disadvantaged business concerns of the SBA, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, veteran-owned small, HUBZone small, small disadvantaged, women-owned small business, and service-disabled veteran-owned trade associations).

6. A statement as to whether or not the offeror included indirect costs in establishing the subcontracting goals, and if so, a description of the method used to determine the proportionate share of indirect costs to be incurred with: (i) small business concerns, (ii) small disadvantaged business concerns, (iii) HUBZone small business concerns, (iv) women-owned small business concerns, (v) veteran-owned small business concerns, (vi) service-disabled veteran-owned small business concerns, (vii) Hispanic Servicing Institutions and Tribal Council Universities, (viii) HBCUs and MIs, and (ix) qualified nonprofit agencies for the blind and other severely disabled.

7. The name of the individual employed by the offeror who will administer the offeror's subcontracting program and a description of the duties of the individual.

Name: _____

Title and Telephone Number: _____

Address: _____

City, State and Zip Code: _____

Duties (Attachment may be used):

8. Describe the efforts the offeror will make to assure that small business concerns, small disadvantaged business concerns, HUBZone small business concerns, women-owned small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small, business concerns, Hispanic Servicing Institutions and Tribal Council Universities, HBCUs and MIs), and qualified nonprofit agencies for the blind and other severely disabled will have an equitable opportunity to compete for subcontractors under this contract.

9. I do herewith assure that this concern will include the clause at FAR 52.219-8 entitled "Utilization of Small Business Concerns" in all subcontracts which offer further subcontracting opportunities and will require all subcontractors (except small business concerns) who receive subcontracts in excess of \$500,000 (\$1,000,000 for construction of any public facility) to adopt a plan similar to the plan agreed to by this concern and in consonance with the FAR clause 52.219-9.

10. I also assure that this concern will (i) cooperate in any studies or surveys as may be required, (ii) submit periodic reports in order to allow the Government to determine the extent of compliance by the offeror with the subcontracting plan, and (iii) submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and SF 295, Summary Subcontract Report, in accordance with the instructions of the forms, and (iv) ensure that the subcontractors under this contract agree to submit the required SF 294s and 295s. I assure that this concern will submit an SF 295 on Corps of Engineers projects only. The SF 295 shall be completed and distributed in accordance with the Corps of Engineers supplemental instructions. I will not report Corps of Engineers projects through any other agency unless authorized by the Contracting Officer.

11. Provide a description of the types of records the offeror will maintain to demonstrate procedures which have been adopted to comply with the requirements and goals set forth in the plan, including the establishment of source lists; and a description of its efforts to locate small business, small disadvantaged business, HUBZone small business, women-owned small business, veteran-owned small business, service-disabled veteran-owned small business, Hispanic Servicing Institutions and Tribal Council Universities, HBCUs and MIs, and qualified nonprofit agencies for the blind and other severely disabled. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

a. Source lists (e.g., PASS), guides, and other data that identify small business, small disadvantaged business, HUBZone small business, women-owned small business, veteran-owned small business, service-disabled veteran-owned small business, Hispanic Servicing Institutions and Tribal Council Universities, HBCUs and MIs), and qualified nonprofit agencies for the blind and other severely disabled.

b. Organizations contacted in an attempt to locate sources that are small business, small disadvantaged business, HUBZone small business, women-owned small business, veteran-owned small business, service-disabled veteran-owned small business, Hispanic Servicing Institutions and Tribal Council Universities, HBCUs and MIs), and qualified nonprofit agencies for the blind and other severely disabled.

c. Records on each subcontract solicitation resulting in an award of more than \$100,000, indicating (1) whether small business concerns were solicited and if not, why not; (2) whether veteran-owned small business concerns were solicited and if not, why not; (3) whether HUBZone small business concerns

were solicited and if not, why not; (4) whether small disadvantaged business concerns were solicited and if not, why not; (5) whether women-owned small business concerns were solicited and if not, why not; (6) whether service-disabled veteran-owned small business concerns were solicited and if not, why not; (7) whether Hispanic Servicing Institutions and Tribal Council Universities concerns were solicited and if not, why not; (8) whether HBCUs and MIs were solicited and if not, why not; (9) whether qualified nonprofit agencies for the blind and other severely disabled were solicited and if not, why not; and (8) if applicable, the reason award was not made to a small business concern.

d. Records of any outreach efforts to contact (A) trade associations, (B) business development organizations, and (C) conferences and trade fairs to locate small business, small disadvantaged business, HUBZone small business, women-owned small business, veteran-owned small business, service-disabled veteran-owned small business, Hispanic Servicing Institutions and Tribal Council Universities, HBCUs and MIs, and qualified nonprofit agencies for the blind and other severely disabled sources.

e. Records of internal guidance and encouragement provided to buyers through (A) workshops, seminars, training, etc., and (B) monitoring performance to evaluate compliance with the programs's requirements.

f. On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having company or division-wide annual plans need not comply with this requirement.

12. Discuss the extent to which the offeror has historically been successful in complying with the requirements of the clauses at FAR 52.219-8, Utilization of Small Business Concerns, and 52.219-9, Small Business Subcontracting Plan, in establishing realistic yet challenging goals and show evidence of ability to achieve the goals. Information addressing past performance on DoD contracts evidencing achievement of established subcontracting goals will be in the form of Standard Forms 294 and 295 (attach these to this plan). Offerors who have had no prior Department of Defense contracts from which to assess past performance will not be penalized. Those who have had prior DoD contracts must provide the SF 294s and 295s on past DoD contracts.

(Signature)

(Title of Corporate Officer)

November 15, 1999

COMPLETION OF AS-BUILT DRAWINGS BY CONSTRUCTION CONTRACTOR

INTRODUCTION:

As-Built drawings are prepared to show changes made to the project during construction, and are the official records of the project at the time of construction completion. All additions, deletions and other changes made during construction are indicated by modifying the original contract drawings. Accurate as-built drawings are very important for operation and maintenance, and when modifications to a facility are made in the future, particularly for plumbing and electrical systems which are hidden from view.

Instructions for preparing high-quality As-Built drawings are contained in the following paragraphs.

MARKED-UP PRINTS: (Working As-Built)

Whenever changes, additions or deletions from the original design are made during construction, they **will immediately** be noted on each of the as-built print set, as appropriate. No other marks, doodles, notes, or annotations shall be put on these sets of as-built prints. All changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction will be accurately and neatly recorded as they occur by means of details and notes. All changes and/or required additions to the paper prints will be clearly identified in color contrasting to blue or black, preferably **red**. The as-built print sets will be annotated in as much detail as necessary to clarify exactly what construction changes were performed.

Areas of Concern: The following are some of the general items that need some special checking to ensure that the marked-up prints are complete and accurate:

- (1) Location, size and type of existing and new utility lines, especially underground lines within the construction area. Measurements will be shown for all change of direction points and all surface or underground components such as valves, manholes, drop inlets, clean outs, meters, etc. The descriptions of exterior utilities shall include the actual quantity, size, and material of the utility lines.
- (2) Layout and schematic drawings of electrical circuits and piping.
- (3) Correct dimensions and details transferred from shop drawings.

- (4) Verification of alignment, cross section, and layout of the earthwork.
- (5) Actual location of anchors, construction and control joints, etc., in concrete.
- (6) Changes in location of equipment and architectural features.
- (7) Cross out such words and phrases as "optimal requirement," "or equal," etc., and list specifically the items of material provided.
- (8) Unusual or uncharted obstructions that are encountered in the contract work area during construction.
- (9) Location, extent, thickness, and size of stone protection particularly where it will be normally submerged by water.

Mark-up Guidelines: The following information is provided to the Contractor as suggestion to improve the quality of the marked-up prints and thereby facilitate preparation of as-built drawings after construction. The most important guideline is that the marked-up changes on the prints shall be complete and understandable. The draftsman who later will make the corrections on the original tracings likely will not have worked on the original design and probably will not have been on-site during the construction of the project. Visits to the site by the draftsman, or visits to the draftsman by the construction superintendent, can be minimized by providing complete and understandable marked-up prints.

- (1) Use written explanations on As-Built drawings more frequently to describe changes - do not rely totally on graphic means to convey the revision.
- (2) Legibility of lettering and digit values shall be precise and clear when marking prints, and clarify ambiguities concerning the nature and application of change involved.
- (3) Wherever a revision is made, make changes to affect related section views, details, legend, profiles, plans and elevation views, schedules, notes and call-out designations, and mark accordingly to avoid conflicting data on all other sheets.
- (4) When changes are made, cross out all features, data and captions that relate to that revision.
- (5) When changes are required on small scale drawings and in restricted areas, suggest large scale inserts be drawn or sketched, with leaders to the location where applicable.

(6) Be sure descriptive markings in red conform with legend symbols shown, or provide a legend if other colors are used.

(7) Be sure to add and denote in legend, any additional equipment or material facilities, service lines, etc., incorporated under As-Built Revision if not already shown in legend.

(8) When attached prints (or sketches) are provided with marked-up print, indicate whether a) entire drawing shall be added to contract drawings or b) whether the contract drawings shall be changed to agree, or c) for reference only to further details not required for initial design.

(9) Make the comments on the drawing complete without reference to letters, memo's, or materials that are not also a part of the As-Built.

(10) Annotating the drawing, "Per Change Order #42," means nothing when the actual change order states, "added an additional 12 duplex" outlets or similar statements. The same is true when the drawing is marked, "changed per COE instructions." This office and ultimately the using organizations must know what was changed, how it was changed, where the items(s) were relocated to and how the affected connections were altered. Change Orders usually do not provide information as to how the facility was changed, only what was changed.

(11) The markups shall be accomplished on blue or black line copies of the **most current originals**. Frequently the packages received consist of blue or black lines which do not include one or more revisions made on the originals through the amendment process prior to contract award. This raises the question, which drawing was used for construction? This is especially true if major revision to the facility have been made on the originals.

(12) Shop drawings are to be incorporated into the As-Built drawings. They will be provided in electronic CAD file format (or 3 mil double matte polyester or photo mylar for non-electronic contracts). Hand drawn or plotted paper shop drawings will not be accepted as submittals.

The quality of shop drawings which normally accompany "As-Built" packages are **not** usable as original drawings for several reasons.

a) The "shop drawings" are not reproducible in blue line form.

b) The drawings are not of an adequate scale or are drawn to no scale and are not transferable to the CORPS drawings due to

lack of information.

c) The limited numbers of reproducible shop drawings that have been received have not been on the Corps of Engineers standard sheets sizes making it difficult to convert these drawings to standard COE drawings.

Any drawing provided by non-COE sources will be drawn in CAD. Sheets shall be drawn at the same scale as similar drawings in the set (example: Fire alarm systems shall be drawn to the same scale as the plumbing or electrical drawings). The drawing shall meet the same standards required for the rest of the drawings set. Details and sketches shall be tied to existing drawings by sheet number, detail number, etc.

AS-BUILT DRAWINGS: (Final As-Builts)

The contractor will transfer the changes from the marked-up prints to the original electronic CAD files (or original mylar drawings).

DRAFTING STANDARDS:

The Corps requires that standard professional engineering drafting practices be utilized in correcting the original contract mylar or electronic CAD drawings to show as-built conditions. In general, the letter styles, line thickness, and scale will be the same as the original drawings. Corrections will be made in black ink, unless the originals are prepared in pencil, in which case the corrections also will be in pencil. When shop drawings or other sheets are added, they will be drawn in electronic CAD or on 3 mil double matte mylar or reproduced on photo mylar and will be the same size and layout as the original drawings. The following specific requirements apply to the preparation of as-built drawings:

The Title Sheet (first sheet): The first sheet will be labeled with the word AS-BUILT (stamp to be purchased by the contractor). The words CONTRACT NUMBER and the actual contract number will be entered using a size 140 Leroy templet and a No. 1 pen (or equal CAD font style and size) as shown on attachment 1. The contract number contains the Fiscal Year, the letter C (for construction), and the sequence number (example: 96-C-0000). No other work need be done on this sheet unless sheets are being added or deleted from the List of Drawings or other actual changes are made on this sheet. (See attachment 1.)

The second and subsequent sheets: All the sheets following the title sheet will be labeled with the AS-BUILT stamp. (See Attachment 2.)

Signature representation (CAD files only): All signatures that appear on the approved original design drawings need to be represented on all the electronic as-built files. The format

for these are /s/Name (i.e. /s/Raymond Dennis). The only name that does not require the /s/ is the District Commander's name that appears only on the cover sheet (the title sheet). (See Attachments 1 & 2.)

Revisions Block entries: Those sheets which have no changes will only be labeled AS-BUILT as described above. Those sheets which have changes shown on them will have REVISED AS-BUILT entered in the first available space. This will be revision one and a number 1 will be entered in the triangle at the beginning of that line. In the event the sheet has already been revised and a number and revision appear in the revision lines the next sequential number will be used. Normally the first entry is made in the first line. The completed originals drawings (or CAD files) will be reviewed for accuracy and initialed by the Contractor. (See Attachments 2 & 3.)

Marking Revisions: All changes will be indicated by placing an equilateral triangle (3/8" per side) near the area revised. Where several items in a table or detail are changed (or completely redrawn), one triangle may be placed near the table or detail title. This same method may be used for general revisions to floor plans and system plans (plumbing, electrical, a/c, heating); when a major portion of the drawing is changed, the triangle may be placed near the diagram, detail, section or plans title. When only a few items are revised, added or deleted a triangle will be placed near each item. The triangles will contain the same number as the As-Built revision on that sheet. (See Attachment 4.)

Revision Procedure: Deletion - when the marked-up print indicates an item was not installed, the item will be crossed out on the drawing along with any associated devices, connecting lines, ducts, pipes etc., including notes and dimensions. When a detail is indicated as not being used, the detail may be boxed and NOT USED lettered across the detail. A box will be drawn on the (reverse side for manual drawings) sheet with an X as shown in Attachment 5. The words NOT USED will be in heavy block lettering a minimum of 5/8" high. A triangle and revision number will be placed inside the box where notes are indicated as not being used. Notes - a line may be drawn thru the note or line item in a table in lieu of erasing the line item or note. The line will be drawn on the reverse side for manual drawings. A triangle and number will be placed near the deleted item. Additions - When the marked-up print indicates items have been added, the new or additional item or items will be drawn on the original and associated connections made if the print indicates such connections. A triangle and number will be placed near the new item. All lettering **will conform** to the existing lettering on each sheet.

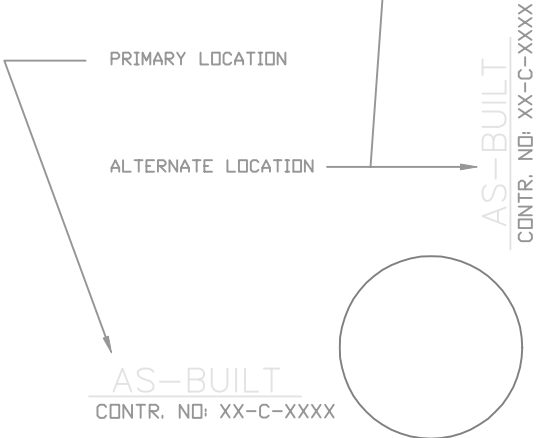
Relocations: When the marked-up print indicates an item has been moved and the new location is shown or indicated, the item will be drawn in the new location and erased from the old location. All connections will be transferred if applicable, such as wiring, piping, ducts. Revision triangles with appropriate number will be shown at the new and old location.

Drawing continuity: The applicable drawings shall be marked-up when a change was made, although this will not always be the case. Final responsibility for drawing continuity is

with the person doing the As-Built. When one floor plan indicates a wall, room, doors etc., has been changed, the same change shall be made on all other applicable drawings. When the change is applicable to only one discipline such as electrical and does not directly affect other discipline sheets, a note may be added to other discipline sheets such as "See sheet _____ for As-Built Conditions."

Shop drawings: When shop drawings are added to the original contract drawing set they need to be appropriately labeled with the Sacramento District file number, and discipline and sequence sheet number. The Index of Drawings will also need to be revised to show the additional sheet (s) with the appropriate sheet title. In the case where the shop drawing are smaller than the Corps standard sheet size (i.e. 8.5"x11" or 11"x17" etc.) the sheets will be cut into a standard Corps sheet size border sheet and appropriately labeled. (For additional information refer to Mark-up Guidelines, Shop drawings above.)

CAD Standards: All asbuilt "triangled" changes (refer to MARKED REVISIONS paragraph above) shall be on a separate single layer named ASBUILT, using a single color with an associated medium pen width. Electronic CAD file and shop drawings will conform to the Sacramento District CAD Standards and the Tri-Services CAD Standards. File Naming Convention will be maintained on all existing CAD files and followed for any new files added. (Refer to <http://www.spk.usace.army.mil/cespk-ed/cadd/standards.html>)



PRIMARY LOCATION

ALTERNATE LOCATION

AS-BUILT
CONTR. NO: XX-C-XXXX

AS-BUILT
CONTR. NO: XX-C-XXXX

Approved Functional Adequacy Title /s/PRINTED NAME MM/DD/YY Date	Designed by DESIGNER Spec No. SPEC File Name FILE_NAME	Drawn by DRAFTER Design File No FILE Plot Date PLOT_DATE	Approved /s/PRINTED NAME MM/DD/YY Chief, Engineering Division Prepared Under the Direction of COMMANDERS NAME Col. Corps of Engineers District Engineer
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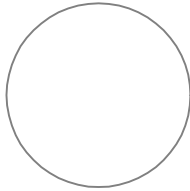
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Sheet reference number: SHT#
SEQ#

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CONTR. NO: XX-C-XXXX

AS-BUILT

PRIMARY LOCATION
ALTERNATE LOCATION



AS-BUILT



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DATE APPROVAL 2	DISCUSSION 2	AA
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DATE APPROVAL 4	DISCUSSION 4	AA
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

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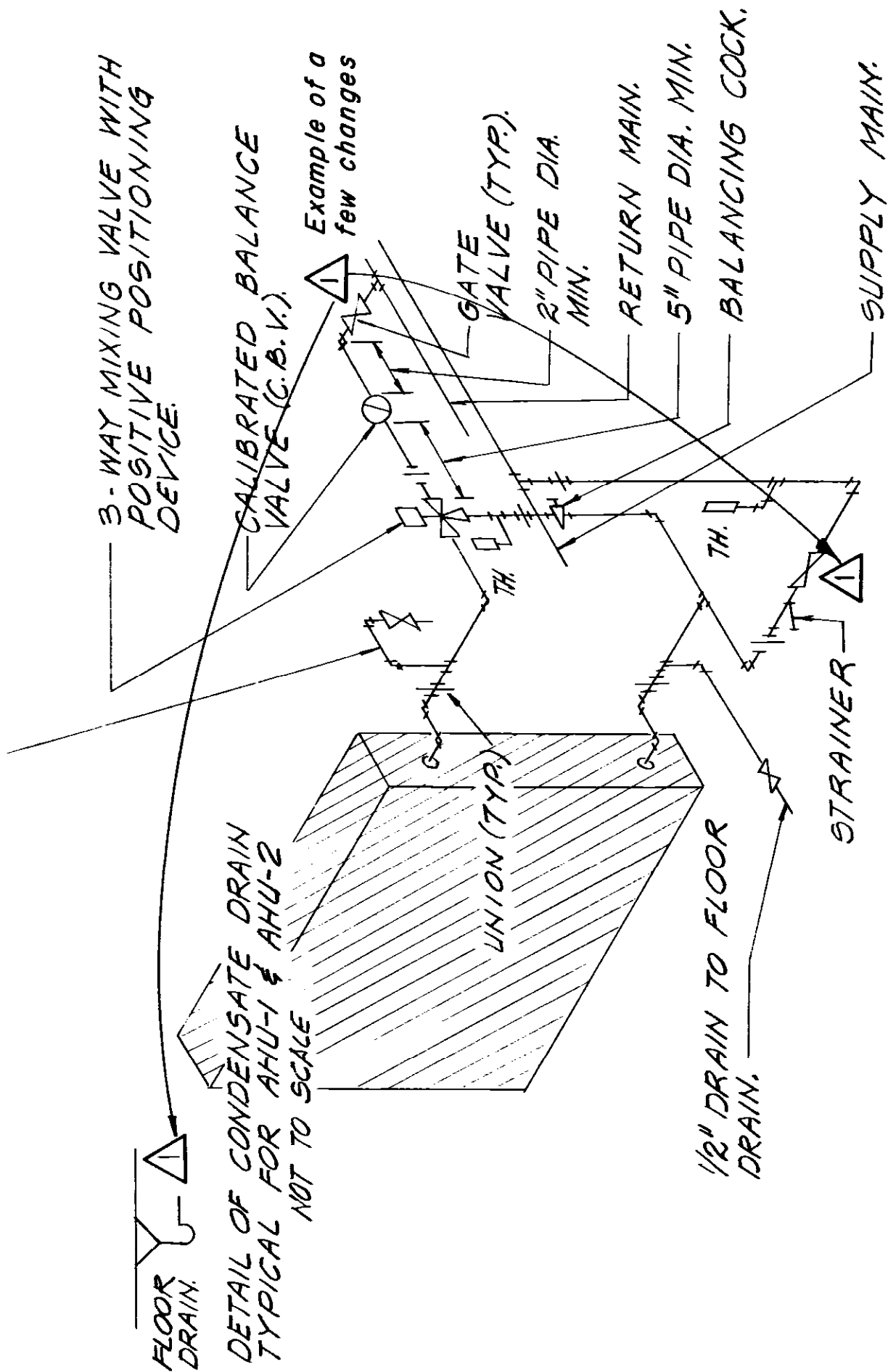
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US Army Corps
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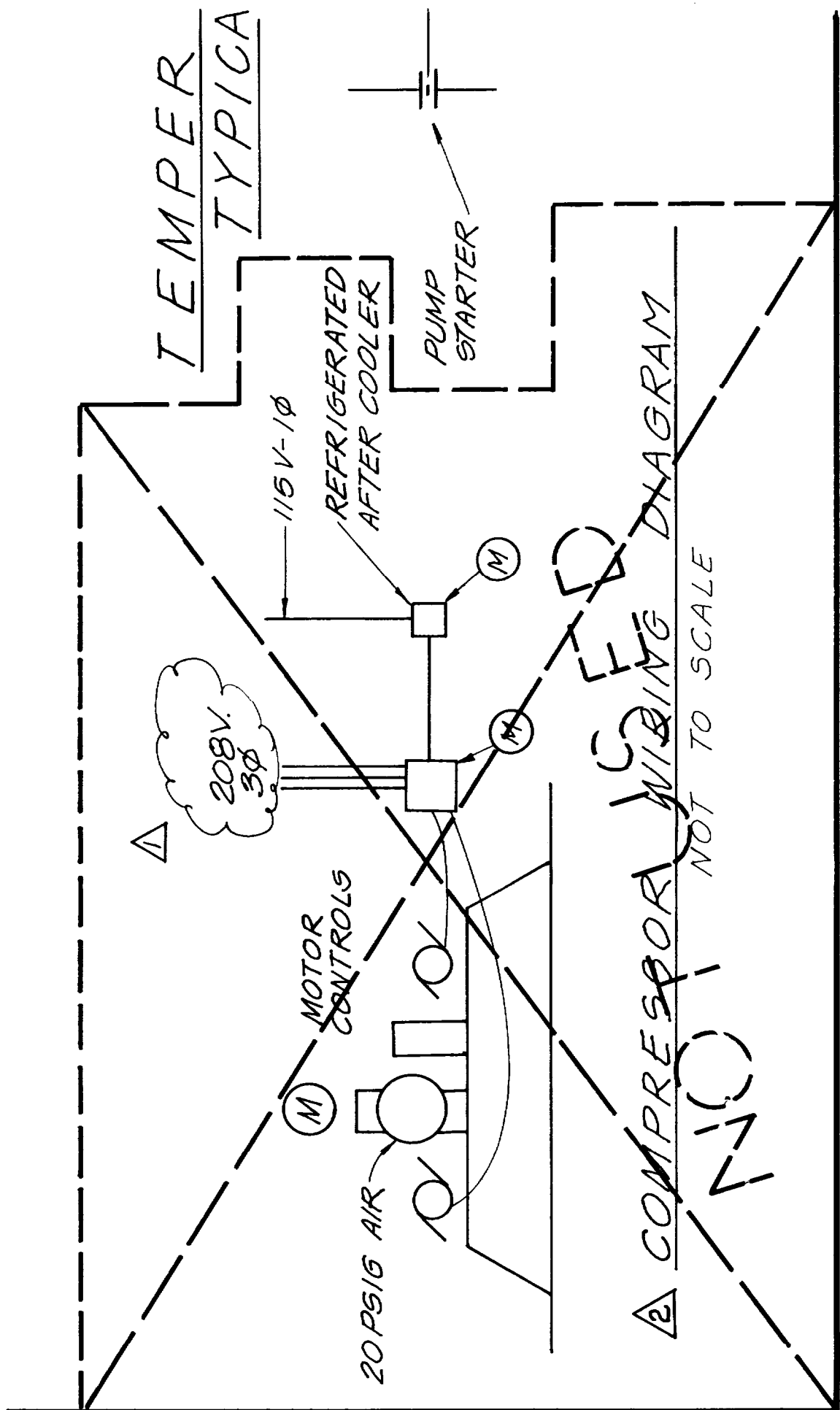
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TYPICAL CONNECTIONS TO CHILLED WATER COILS.

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Example of general revisions



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US Army Corps
of Engineers

ENGINEERING AND CONSTRUCTION BULLETIN

No. 2002-14

Issuing Office: CECW-ET / CEMP-MA

Issued: 22 May 2002

Expires: 22 May 2004

Subject: MILCON Project Close-out, The RED ZONE Meeting

Applicability: Guidance

1. The U.S. Army Corps of Engineers is endorsing the Air Force's Air Combat Command (ACC) initiative called *The Red Zone Meeting* as an approach for timely completion and close-out for MILCON projects. The Red Zone meeting gets its name from the football term used to describe the team effort to move the ball the last 20 yards into the end zone. The close-out of a MILCON project sometimes can be equally as hard and most definitely requires the whole team's efforts.
2. The Red Zone meeting is held approximately 60 days before the anticipated Beneficial Occupancy Date (BOD). The whole Project Delivery Team (PDT) meets to discuss the close-out process, to build a schedule of events and assign responsibilities for actions necessary to produce a timely physical as well as fiscal close-out of the project. Enclosed is a copy of the ACC brochure describing their program.
3. The Corps of Engineers will apply the Red Zone meeting process to all MILCON projects. The Red Zone meeting should be included in every Project Management Plan (PMP). Ongoing projects with existing PMPs should incorporate Red Zone meetings if project BOD has not been reached. The Corps Project Manager will chair the meeting and ensure all the key players are in attendance. The enclosed sample checklist will help to ensure key milestones are discussed. The Word file for the sample checklist will be sent out with the distribution of this Engineering and Construction Bulletin. This file can be customized to include unique requirements for individual projects.
4. The Red Zone Video has been loaded on the Corps' FTP site at <ftp://ftp.hq.usace.army.mil/video>. The file name is *RedZonepressd.avi*. There are a few options to view the video: 1) You can double-click on the file name and the file will download and you can view through Windows Media Player. This download can take up to 5 minutes or so depending on your computer and Network traffic; 2) You can create a CD of the video by right clicking on the file at the ftp site. Choose "Save Target As" and a dialogue box will open up. Choose the directory where you want to save the file to and save the video file. Once the file is saved, then use your own CD creation software (like Adaptec) to create the CD. After you verify that the CD works, you can delete the file from your hard drive; and 3) Contact your local help desk and have the file copied to your local server and then you can view through the Media Player (as described above) but it will be faster than from the FTP site.

DWIGHT BERANEK, P.E.
Chief, Engineering and Construction Division
Directorate of Civil Works

J. JOSEPH TYLER, P.E.
Chief, Programs Management Division
Directorate of Military Programs

SAMPLE
Red Zone Meeting Checklist
Date: _____

Contract No.	
Description / Location	
Contractor	
Contracting Officer	

Action	Completion Milestone	√
Inspections		
Fire		
Safety		
Pre-final		
Mechanical Test & Balance		
Commissioning		
Landscaping Complete		
Beneficial Occupancy Date (BOD)		
Furniture Installation		
Comm Installation		
As-Built Contract Drawings		
Provide all O&M manuals, tools, shop drawings, spare parts, etc. provided to customer		
Provide Warranty documents to Customer		
Contract completion		
Final Inspection		
User move-in		
DD Form 1354, Transfer of Real Property completed & signed		
Ribbon cutting		
DD Form 2626 - Construction Contractor Performance Evaluation		
DD Form 2631 – A-E Performance Rated after Construction		
Final Payment Completed		
Release of Claims		
Return of Unobligated Funds		
Move Project from CIP to General Ledger		
Financial completion		

TECHNICAL SPECIFICATIONS

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- 1.3 SYSTEM REQUIREMENTS
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SECTION 01312A

QUALITY CONTROL SYSTEM (QCS)

1.1 GENERAL

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data

1.1.1 Correspondence and Electronic Communications

For ease and speed of communications, both Government and Contractor will, to the maximum extent feasible, exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

1.1.2 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01320A, PROJECT SCHEDULE, Section 01330, SUBMITTAL PROCEDURES, and Section 01451A, CONTRACTOR QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

1.2 QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor shall be responsible to download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on 3-1/2 inch high-density diskettes or CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

1.3 SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

Hardware

IBM-compatible PC with 200 MHz Pentium or higher processor

32+ MB RAM

4 GB hard drive disk space for sole use by the QCS system

3 1/2 inch high-density floppy drive

Compact disk (CD) Reader

Color monitor

Laser printer compatible with HP LaserJet III or better, with minimum 4 MB installed memory.

Connection to the Internet, minimum 28 BPS

Software

MS Windows 95 or newer version operating system (MS Windows NT 4.0 or newer is recommended)

Word Processing software compatible with MS Word 97 or newer

Internet browser

The Contractor's computer system shall be protected by virus protection software that is regularly upgraded with all issued manufacturer's updates throughout the life of the contract.

Electronic mail (E-mail) compatible with MS Outlook

1.4 RELATED INFORMATION

1.4.1 QCS User Guide

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website; the Contractor can obtain the current address from the Government. In case of justifiable difficulties, the Government will provide the Contractor with a CD-ROM containing these instructions.

1.4.2 Contractor Quality Control(CQC) Training

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

1.5 CONTRACT DATABASE

Prior to the pre-construction conference, the Government shall provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by files attached to E-mail. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.6 DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Data updates to the Government shall be submitted by E-mail with file attachments, e.g., daily reports, schedule updates, payment requests. If permitted by the Contracting Officer, a data diskette or CD-ROM may be used instead of E-mail (see Paragraph DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM). The QCS database typically shall include current data on the following items:

1.6.1 Administration

1.6.1.1 Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format via E-mail.

1.6.1.2 Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format via E-mail.

1.6.1.3 Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main) office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

1.6.1.4 Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.6.1.5 Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC

comments, Submittal Register Status, Three-Phase Inspection checklists.

1.6.2 Finances

1.6.2.1 Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

1.6.2.2 Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet and include it with the payment request. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment requests with supporting data by E-mail with file attachment(s). If permitted by the Contracting Officer, a data diskette may be used instead of E-mail. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

1.6.3 Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01451A, CONTRACTOR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a data diskette or CD-ROM reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

1.6.3.1 Daily Contractor Quality Control (CQC) Reports.

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by Section 01451A, CONTRACTOR QUALITY CONTROL. Reports shall be submitted electronically to the Government using E-mail or diskette within 24 hours after the date covered by the report. Use of either mode of submittal shall be coordinated with the Government representative. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

1.6.3.2 Deficiency Tracking.

The Contractor shall use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch

list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

1.6.3.3 Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

1.6.3.4 Accident/Safety Tracking.

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This brief supplemental entry is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 200.

1.6.3.5 Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

1.6.3.6 QC Requirements

The Contractor shall develop and maintain a complete list of QC testing, transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work progresses, and shall promptly provide this information to the Government via QCS.

1.6.4 Submittal Management

The Government will provide the initial submittal register, ENG Form 4288, SUBMITTAL REGISTER, in electronic format. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

1.6.5 Schedule

The Contractor shall develop a construction schedule consisting of pay activities, in accordance with Contract Clause "Schedules for Construction Contracts", or Section 01320A, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01320A PROJECT SCHEDULE). The updated schedule data shall be included with each

pay request submitted by the Contractor.

1.6.6 Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data, and schedule data using SDEF.

1.7 IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

1.8 DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of updates, payment requests, correspondence and other data is by E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of computer diskettes or CD-ROM for data transfer. Data on the disks or CDs shall be exported using the QCS built-in export function. If used, diskettes and CD-ROMs will be submitted in accordance with the following:

1.8.1 File Medium

The Contractor shall submit required data on 3-1/2 inch double-sided high-density diskettes formatted to hold 1.44 MB of data, capable of running under Microsoft Windows 95 or newer. Alternatively, CD-ROMs may be used. They shall conform to industry standards used in the United States. All data shall be provided in English.

1.8.2 Disk or CD-ROM Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

1.8.3 File Names

The Government will provide the file names to be used by the Contractor with the QCS software.

1.9 MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions. The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

1.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

-- End of Section --

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SECTION 01320

PROJECT SCHEDULE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ENGINEERING REGULATIONS (ER)

ER 1-1-11 (1995) Progress, Schedules, and Network Analysis Systems

1.2 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS, a Project Schedule as described below shall be prepared. The scheduling of construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel will result in an inability of the Contracting Officer to evaluate Contractor's progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, then the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the Project Schedule shall be capable of providing all requirements of this specification. Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer.

3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in either the Precedence Diagram Method (PDM).

3.3.2 Level of Detail Required

The Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule. The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule.

3.3.2.1 Activity Duration

Contractor submissions shall follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods (usually less than 2 percent of all non-procurement activities' Original Durations are greater than 20 days).

3.3.2.2 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, and delivery.

3.3.2.3 Government Activities

Government and other agency activities that could impact progress shall be shown. These activities include, but are not limited to: approvals, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

3.3.2.4 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, contractor work force, or government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

3.3.2.5 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

3.3.2.6 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number. Whenever possible, changes shall be added to the schedule by adding new activities. Existing activities shall not normally be changed to reflect modifications.

3.3.2.7 Bid Item

All activities shall be identified in the project schedule by the Bid Item to which the activity belongs. An activity shall not contain work in more than one bid item. The bid item for each appropriate activity shall be identified by the Bid Item Code.

3.3.2.8 Phase of Work

All activities shall be identified in the project schedule by the phases of work in which the activity occurs. Activities shall not contain work in more than one phase of work. The project phase of each activity shall be by the unique Phase of Work Code.

3.3.2.9 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited, to the procurement chain of activities including such items as submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

3.3.2.10 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

3.3.3 Scheduled Project Completion

The schedule interval shall extend from NTP to the contract completion date.

3.3.3.1 Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity call "End Project". The "End Project" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.3.3 Early Project Completion

In the event the project schedule shows completion of the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted in the narrative report at every project schedule update period to assist the Contracting Officer in evaluating the Contractor's ability to actually complete prior to the contract period.

3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

3.3.4.2 End Phase

The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.4.3 Phase X

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes.

3.3.6 Out-of-Sequence Progress

Activities that have posted progress without all preceding logic being satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case approval of the Contracting Officer. The Contractor shall propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule.

3.3.7 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

3.4.1 Preliminary Project Schedule Submission

The Preliminary Project Schedule, defining the Contractor's planned operations for the first 60 calendar days shall be submitted for approval within 20 calendar days after the NTP is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 60 calendar days after NTP.

3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 40 calendar days after NTP. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail.

3.4.3 Periodic Schedule Updates

Based on the result of progress meetings, specified in "Periodic Progress Meetings," the Contractor shall submit periodic schedule updates. These submissions shall enable the Contracting Officer or to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgement of the Contracting Officer or authorized representative, is necessary for verifying the contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

3.4.4 Standard Activity Coding Dictionary

The Contractor shall use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used.

3.5 SUBMISSION REQUIREMENTS

The following items shall be submitted by the Contractor for the preliminary submission, initial submission, and every periodic project schedule update throughout the life of the project:

3.5.1 Data Disk

Two data disks containing the project schedule shall be provided. Data on the disks shall adhere to the SDEF format specified in ER 1-1-11, Appendix A.

3.5.1.1 File Medium

Required data shall be submitted on 3.5 disks, formatted to hold 1.44 MB of data, under the MS-DOS Version 5. or 6.x, unless otherwise approved by the Contracting Officer.

3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Preliminary, Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number of person responsible for the schedule, and the MS-DOS version used to format the disk.

3.5.1.3 File Name

Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

3.5.2 Narrative Report

A Narrative Report shall be provided with the preliminary, initial, and each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to relay to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis.

3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float. Actual Start and Actual Finish Dates shall be printed for those activities in progress or completed.

3.5.4.1 Activity Report

A list of all activities sorted according to activity number.

3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in ascending order by activity number. Preceding and succeeding activities shall include all information listed above in paragraph Schedule Reports. A blank line shall be left between each activity grouping.

3.5.4.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates. Completed activities shall not be shown on this report.

3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the NTP until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by bid item and sorted by activity numbers. This report shall: sum all activities in a bid item and provide a bid item percent; and complete and sum all bid items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

3.5.5 Network Diagram

The network diagram shall be required on the initial schedule submission and on monthly schedule update submissions. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity number, description, duration, and estimated earned value shall be shown on the diagram.

3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.5.3 Critical Path

The critical path shall be clearly shown.

3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity

sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

3.5.5.5 S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly onsite meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor shall describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer will approve activity progress, proposed revisions, and adjustments as appropriate.

3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost-to-Date shall be subject to the approval of the Contracting Officer. As a minimum, the Contractor shall address the following items on an activity by activity basis during each progress meeting.

3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish dates for each activity currently in-progress or completed.

3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations must be based on Remaining Duration for each activity.

3.6.3.3 Cost Completion

The earnings for each activity started. Payment will be based on earnings for each in-progress or completed activity. Payment for individual activities will not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

3.6.3.4 Logic Changes

All logic changes pertaining to Notice to Proceed on change orders, change orders to be incorporated into the schedule, contractor proposed changes in

work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) delays beyond the Contractor's control, such as strikes and unusual weather. 2) delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary, and 3) Changes required to correct a schedule which does not represent the actual prosecution and progress of the work.

3.7 REQUESTS FOR EXTENSIONS

In the event the Contractor requests an extension of the contract completion date, or any interim milestone date, the Contractor shall furnish the following for a determination as to whether or not the Contractor is entitled to an extension of tie under the provisions of the contract: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

3.7.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request.

The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, will not be a cause for a time extension to the contract completion date.

3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of under 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

3.7.2.1 Affected Activities

A list of affected activities, with their associated project schedule activity number.

3.7.2.2 Explanation

A brief explanation of the causes of the change.

3.7.2.3 Analysis

An analysis of the overall impact of the changes proposed.

3.7.2.4 Sub-Network

A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

3.7.3 Additional Submission Requirements

For any requested time extension of over 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

3.8 DIRECTED CHANGES

If NTP is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

-- End of Section --

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SECTION 01330

SUBMITTAL PROCEDURES

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SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUBMITTAL IDENTIFICATION

SD-01 Data

SD-04 Drawings

SD-06 Instructions

SD-07 Schedules

SD-08 Statements

SD-09 Reports

SD-13 Certificates

SD-14 Samples

SD-18 Records

SD-19 Operation and Maintenance Manuals

1.2 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.2.1 Government Approved

Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.2.2 Information Only

All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.3 SUBMITTAL REVIEW AND APPROVAL

Before submission, Contractor shall review all submittals prepared by subcontractors, suppliers, and himself, for completeness, accuracy, and compliance with plans and specifications. Contractor shall not use red markings on submittals. Red markings are reserved for use by the Contracting Officer. Approval by Contractor shall be indicated on each drawing by an "Approved" stamp with Contractor's name, signature, and date. The Contractor shall have independent agents not associated with his organization to do the review. The review shall be done by a licensed architect or registered engineers in the appropriate disciplines of architectural, civil, structural, mechanical and electrical, as appropriate. The reviews shall be thorough and complete and authenticated by registered engineer's or architect's stamp. This administration of submittal review must be integrated into the Contractor's Quality Control Plan. The plan must delineate in precise detail how the Contractor intends to satisfy this requirement. This should include names of organizations, qualifications and names of individuals who will be doing the work with their qualifications/resumes. Supplier's or subcontractors certifications are not acceptable as meeting this requirement of independent review. Submittals not conforming to the requirements of this section will be returned to the Contractor for correction and resubmittal.

1.4 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.5 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.6 PAYMENT FOR ITEMS FOR WHICH A SUBMITTAL AND APPROVAL IS REQUIRED

In accordance with FAR 52.232-5, "Payments Under Fixed-Price Construction Contracts", the Government shall make progress payments to the Contractor monthly based on estimates of work accomplished which meets the standards of quality established under the contract. On items for which submittals must be approved by the Contracting Officer, payment cannot be made for the item until the Government establishes that the item "meets the standards of quality" required by the contract. The Contractor shall not invoice for, nor shall the Government make payment for any item, for which submittal and approval is required, until the item has been submitted and approved as described herein.

1.7 ADDITIONAL GOVERNMENT APPROVED SUBMITTALS

In addition to those specified in paragraph 1.2 SUBMITTAL CLASSIFICATION, the following classifications of submittals also require Government Approval.

Mechanical and Electrical Systems, and Fire Protection and Fire Detection Submittals.

1.7.1 Special Reviews

- a. Mechanical and Electrical Systems: The Contractor shall furnish one reproducible, unfolded copy of all wiring and control diagrams and approved system layout drawings with the operating instructions called for under the various headings of these specifications for mechanical and electrical systems.

1.8 CERTIFICATES OF COMPLIANCE

Any certificates required for demonstrating proof of compliance of materials with specification requirements shall be executed in the number of copies required by the above paragraph 3.5.1 "Procedures". Each certificate shall be signed by an official authorized to certify in behalf of the manufacturing company and shall contain the name and address of the Contractor, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Contractor from furnishing satisfactory material, if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) System Manager and each item shall be stamped, signed, and dated by the CQC System Manager indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

3.2 SUBMITTAL REGISTER (ENG FORM 4288)

See Section 01012, Paragraph 2.18 for information regarding the Submittal Register Form. The submittal register and the progress schedules shall be coordinated.

3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently.

Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 35 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals.

3.4 TRANSMITTAL FORM (ENG Form 4025)

The Contractor shall complete ENG Form 4025, "Transmittal of Shop Drawings, Equipment Data, Material Samples, or Manufacturer's Certificates of Compliance" and forward four (4) copies of same with each set of shop drawings, certificates of compliance, materials, fixtures and equipment lists submitted for approval. Three (3) copies of the ENG Form 4025 shall be submitted for information only data. No translucent or coated reproduced copies will be accepted. Each item submitted shall be listed separately on the ENG Form 4025. For new submittals or resubmittals mark the appropriate box; or resubmittals also insert previous transmittal number. Blank ENG Forms 4025 will be furnished by the Contracting Officer on request. Shop drawings shall be either blue line or black line prints on a white background. Blueprints are not acceptable. Each submittal shall be identified with the Contractor's name, Contract Number, Transmittal Number, and Item Number to correspond with Item Number listed on ENG Form 4288. The following identification shall be marked on submittals as applicable:

Contract Number
 Project Title and Location
 Subcontractor's Name
 Supplier's Name or Manufacturer's Name
 Specification Section and Paragraph Number
 Contract Drawing File Number

3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

3.5.1 Procedures

Submittals required by the CONTRACT CLAUSES and other non-technical parts of the contract are not included in this section. The Contractor shall submit to the Contracting Officer: four (4) copies for approval, and three (3) copies for information only, of all shop drawings, certificates of compliance, materials, fixtures and equipment lists called for under the various headings of these specifications. These drawings, certificates and lists shall be complete and detailed and, prior to submission, must be reviewed and certified correct by the Contractor as required by the Quality Control System paragraph of the Construction Quality Control Section. If approved by the Contracting Officer, three (3) sets of all submittals will be retained by the Contracting Officer and one (1) set will be returned to the Contractor. Submittals for information only usually will not be returned. The Contractor is encouraged to submit paper documents that are printed/copied double-sided on recycled paper that has at least 20% postconsumer material.

(a) Resubmittals:

(1) If a submittal is returned for correction or is not satisfactory and is disapproved by the Contracting Officer, the Contractor shall resubmit the corrected material in the same quantity, including reproduces as specified for the original submittal for approval within 14 days after receipt by him of the disapproved material.

3.5.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3.6 NOT APPLICABLE

3.7 SPARE PARTS LIST AND MAINTENANCE OPERATIONS MANUALS

Within 30 calendar days after approval of shop drawings and equipment lists, the Contractor shall submit, to the Contracting Officer, 3 copies of spare parts lists and operating and maintenance manuals as required under the various headings of these specifications. One reproducible, unfolded copy shall be provided of all operating instructions, control diagrams, etc., that are larger than 8-1/2-inches by 11-inches; this does not apply to standard manufacturer's data.

(A) Spare parts lists shall contain the following listed information:

(1) Quantity of parts required for 120 days and one year of operation.

- (2) Description of each spare part.
- (3) Drawing number and shop drawing reference.
- (4) Part equipment code number.
- (5) Unit price of each item.
- (6) Total price of all items.
- (7) Procurement lead time with particular attention to long lead times.
- (8) Name and address of nearest supplier.
- (9) Such remarks and data as the manufacturer may consider pertinent.
- (10) Complete parts list of all replaceable items.

(B) Operation, Maintenance, and Repair Manuals and Instructions:

(1) The requirements for furnishing operating, maintenance, and repair data/manuals and field instructions under this contract are specified in the Technical Specifications. The Contractor shall submit to the Contracting Officer, not later than 60 calendar days after the Notice to Proceed, an outline showing the proposed submittal date(s) of operation and maintenance manuals to be furnished the Government and the scheduled date(s) of all required field instructions to be provided by Contractor furnished personnel or manufacturer's representatives. All operation and maintenance manuals must be furnished to the Contracting Officer not later than 60 calendar days prior to turnover of the facility to the Government.

(2) Failure on the part of the Contractor to comply with requirements of this clause will result in no further payment until all required O&M data/manuals are submitted and accepted.

(3) All O&M data/manuals submittal data shall be entered in a separate section of the master submittal register.

(4) Six O & M Manuals are required. The Contractor shall provide a lockable cabinet located in the Mechanical Room. One master O&M Manual shall be placed in this cabinet. The other 5 O&M Manuals shall be provided to the Contracting Officer. Location of the cabinet shall be shown on the mechanical room layout drawing.

3.8 NOT APPLICABLE

3.9 AS-BUILT DRAWINGS

([Internet Address: http://www.cbbs.spk.usace.army.mil/html/aeguide.html](http://www.cbbs.spk.usace.army.mil/html/aeguide.html).)

(A) Working As-Built Drawings. The Contractor shall maintain a current record of the work as actually constructed in the form of working as-built drawings. These will typically be red-line mark-ups of the construction plans. The quantity of sets to be red-lined can be found under the paragraph below, Submittal Requirements for Review and Approval. It is the Contractor's responsibility to ensure the use of the most current drawings. Subject to the approval of the Contracting Officer, a member of the Contractor's Quality Control Organization will be assigned the sole responsibility for the maintenance and currency of the as-built drawings. Any reassignment of duties concerning the maintenance of the as-built drawings will be promptly reported to the Contracting Officer. Guidelines and drafting standards for preparing working and final as-built drawings can be found on the Internet.

These instructions include submittal requirements for shop drawings.

(B) Final As-Built Drawings. The Contractor shall prepare final, record copy drawings which depict the actual conditions upon completion of construction. The deliverable required shall be in both hard copy and electronic format.

1. Submittal Requirements for Review and Approval.

a. Timeframes

(1) Working as-built drawings.(GA) Three sets of red-line markups shall be submitted after the completion of each major phase of work (or bid items, if appropriate), in conjunction with approval of progress payments.

(2) Final as-built drawings.(GA) All three sets of red-line markups and one new set (hard copy bond or blue-line) of completed final as-built drawings shall be submitted for review within 10 working days prior to the pre-final inspection. If upon review, the drawings are found to contain errors and/or omissions, they shall be returned to the Contractor for corrections.

Within 15 calendar days after the final project inspection, the Contractor shall submit for approval the one copy of updated red-line mark-up CADD files depicting final as-built conditions. If upon review by the Sacramento District, the drawings are found to contain errors and/or omissions, they shall be returned to the Contractor for corrections.

Within 45 calendar days after the final inspection, the Contractor shall transfer the final as-built drawings to the Government according to paragraph, End-User (Customer Requirements).

(C) End-User (Customer) Requirements

1. CADD Format.

AutoCAD Release 14 for use on NT 4.0 Operating System (No conversion of format will be allowed.)

2. Hard Copy Media and Quantities.

One full size 22" x 34" on vellum and two (2) half-size 11"x17" on bond.

(D) Delivering electronic files.

Specific instructions for labeling disks or CD-ROMs, directory structure, indexing and additional documentation requirements are listed on the Internet.

3.10 GEOTECHNICAL AND CONCRETE MATERIALS REPORT

Contractor shall prepare an as constructed geotechnical and concrete materials report for project. For additional information see ([Internet Address: http://www.cbbs.usace.army.mil/net/usace-docs/eng-regs/er1110-1-1901/toc.htm](http://www.cbbs.usace.army.mil/net/usace-docs/eng-regs/er1110-1-1901/toc.htm))

3.11 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.12 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. Three (3) copies of the submittal will be retained by the Contracting Officer and one (1) copies of the submittal will be returned to the Contractor.

3.13 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

3.14 COLOR BOARDS

Three (3) sets of color boards shall be submitted within 90 calendar days after receipt of Notice to Proceed for all projects which involve building construction or building modifications. The board shall include samples of colors and finishes of all interior surfaces such as walls, floors, and ceilings. Material shall be submitted in a standard 8-1/2 inches by 11 inches three-ring binder. Fold-outs may be employed to 25-1/2 inches by 33 inches as long as they refold within the standard binder. Actual material samples shall be displayed showing color, texture, pattern, finish, thickness, etc., for all appearance related items where choice exists. These samples shall be large enough to indicate true patterns. However, care should be taken to present materials in proportion to that which may be installed in a given situation. Samples shall be organized by color schemes with a separate sample for each scheme. The schemes shall be coordinated by room names and numbers shown on the architectural floor plans. Colors shall be labeled with generic color names. Project title and location (Base) shall be placed in the lower right-hand corner of each module. Where special finishes such as architectural concrete, carpet, or prefinished textured metal panels are required, separate samples not less than 8 inches x 10 inches square shall be submitted with the board. If more space is needed, more than one board per set may be submitted. The Contractor shall certify that he has reviewed the color boards in detail and that they are in strict accordance with the contract drawings and specifications except as may be otherwise explicitly stated. Submittal of the color board shall not relieve the Contractor of the responsibility to submit the samples required by the Technical Specifications.

For additional information regarding color board requirements, see Sections 01010 and 01011.

3.16 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

<p>CONTRACTOR</p> <p>(Firm Name)</p> <p>_____ Approved</p> <p>_____ Approved with corrections as noted on submittal data and/or attached sheets(s).</p> <p>SIGNATURE: _____</p> <p>TITLE: _____</p> <p>DATE: _____</p>

-- End of Section --

SUBMITTAL REGISTER													CONTRACT NO.				
TITLE AND LOCATION Ft. Irwin ACP													CONTRACTOR				
TRANSMITTAL NO	SPEC NO	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS		
					SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION	ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM CONTR	DATE OF ACTION			DATE OF ACTION	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	01780A	SD-02 Shop Drawings															
		As-Built Drawings	1.2.1														
		FIO															
		SD-03 Product Data															
		As-Built Record of Equipment and Materials	1.2.2														
		FO															
		Warranty Management Plan	1.3.1														
		FIO															
		Warranty Tags	1.3.5														
		Final Cleaning	1.6														
	02220	SD-03 Product Data															
		Work Plan															
		RO															
	02231	SD-03 Product Data															
		Materials Other Than Salable Timber															
	02300	SD-07 Certificates															
		Field Testing Control	3.8														
		SD-01 Preconstruction Submittals															
		Borrow Material	2.1.2	G													
		Satisfactory Material	1.3.1	G													
		SD-09 Manufacturer's Field Reports															
		Field Testing Control	3.8														
	02315	SD-06 Test Reports															

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					SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION		DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE				
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	02315	Field Density	3.9.1	G													
		FIELD TESTING CONTROL	3.9	G													
		Satisfactory material															
	02316	SD-06 Test Reports															
		Field Testing Control	3.4														
		Initial Backfill Materials	2.1.3	G													
	02531	SD-03 Product Data															
		Pipeline materials	2.1														
		SD-07 Certificates															
		Portland Cement															
		[], []															
		Joints															
	02722a	SD-03 Product Data															
		Plant, Equipment, and Tools	1.6														
		SD-06 Test Reports															
		Sampling and testing	1.4	G													
		Field Density Tests	1.4.2.4														
	02741a	SD-03 Product Data															
		Mix Design	2.3	G													
		Contractor Quality Control	3.10	G													
		Material Acceptance	3.11	G													
		SD-04 Samples															
		Asphalt Cement Binder	2.2														
		Aggregates	2.1														
		SD-06 Test Reports															
		Aggregates	2.1	G													

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					SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION	ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	DATE OF ACTION			DATE OF ACTION	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	02741a	QC Monitoring	3.10.3.10G														
		SD-07 Certificates															
		Asphalt Cement Binder	2.2	G													
		Testing Laboratory	3.6	G													
	02748A	SD-03 Product Data															
		Waybills and Delivery Tickets															
		SD-06 Test Reports															
		Sampling and Testing															
	02754a	SD-03 Product Data															
		Equipment	1.6	G													
		Paving	3.5	G													
		Mixture Proportions	2.11	G													
	02762	SD-05 Design Data															
		Test Reports	1.4	G													
		Equipment List	1.5	G													
		Manufacturer's Instructions		G													
		SD-04 Samples															
		Compression Seals	2.1	G													
	02763a	SD-03 Product Data															
		Equipment	1.4	G													
		Composition Requirements															
		Qualifications															
		SD-06 Test Reports															
		Sampling and Testing	2.4														
		SD-07 Certificates															

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TRANSMITTAL NO	SPEC	DESCRIPTION ITEM SUBMITTED	PARAGRAPH#	GOVERNMENT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS		
					SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE OF ACTION					
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	02763a		Volatile Organic Compound (VOC)														
	02840a		SD-02 Shop Drawings														
			Installation	3.1	G												
			ED														
			Equipment		G												
			SD-03 Product Data														
			Vehicle Barriers		G												
			Spare Parts	1.6	G												
			SD-06 Test Reports														
			Field Testing	3.4													
			SD-10 Operation and Maintenance														
			Data														
			Vehicle Barriers														
			Operating and Maintenance	3.5													
			Instructions														
	03101a		SD-02 Shop Drawings														
			Shop Drawings	1.4	G												
			SD-03 Product Data														
			Materials	2.1													
			SD-06 Test Reports														
			Inspection	3.3													
	03200a		SD-02 Shop Drawings														
			Reinforcement	3.1	G												
			SD-03 Product Data														
			Welding	1.3													

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION			(m)	(n)	(o)		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		03200a	SD-07 Certificates														
			Reinforcing Steel	2.3													
		03307a	SD-03 Product Data														
			Air-Entraining Admixture	2.1.3.1	G												
			Accelerating Admixture	2.1.3.2	G												
			Water-Reducing or Retarding Admixture	2.1.3.3	G												
			Curing Materials	2.1.8	G												
			Expansion Joint Filler Strips, Premolded	2.1.5	G												
			Joint Sealants - Field Molded Sealants	2.1.6	G												
			Batching and Mixing Equipment	3.1.5.3	G												
			Conveying and Placing Concrete	3.2	G												
			Color Samples		G												
			SD-06 Test Reports														
			Aggregates	2.1.2	G												
			Concrete Mixture Proportions	1.3.3	G												
			SD-07 Certificates														
			Cementitious Materials	2.1.1	G												
			Aggregates	2.1.2	G												
	04200		SD-02 Shop Drawings														
			Masonry Work		G												
			SD-03 Product Data														
			Cold Weather Installation	3.1.2	G												
			SD-04 Samples														

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					SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	DATE OF ACTION				
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	04200	Concrete Masonry Units (CMU)	2.2	G													
		Anchors, and Bar Positioners	2.8														
		Expansion-Joint Materials	2.11														
		Portable Panel	1.3	G													
		SD-05 Design Data															
		Pre-mixed Mortar	2.5.4														
		Unit Strength Method															
		SD-06 Test Reports															
		Efflorescence Test	3.17.3	G													
		Field Testing of Mortar	3.17.1	G													
		Field Testing of Grout	3.17.2	G													
		Prism tests	3.17.4	G													
		Masonry Cement	2.5.3	G													
		Fire-rated CMU	2.2.3	G													
		Special Inspection	1.5.1	G													
		SD-07 Certificates															
		Concrete Masonry Units (CMU)	2.2														
		Control Joint Keys	2.10														
		Anchors and Bar Positioners	2.8														
		Expansion-Joint Materials	2.11														
		Reinforcing Steel Bars and Rods	2.9														
		Masonry Cement	2.5.3														
		Mortar Coloring	2.5.2														
		Admixtures for Masonry Mortar	2.5.1														
		Admixtures for Grout	2.7.1														
	04810A	SD-04 Samples															

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TRANSMITTAL NO	SPEC NO	DESCRIPTION ITEM SUBMITTED	PART A / R A G# A A P H	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS		
					SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE OF ACTION					
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		04810A	Concrete Masonry Unit	2.1.1	G RE 04												
			SD-07 Certificates														
			Concrete Masonry Unit	2.1.1													
			[], []														
		04850	SD-04 Samples														
			Stone Veneer Unit	2.1.1	G RE 04												
			SD-07 Certificates														
			Stone Veneer														
			[], []														
		05120	SD-02 Shop Drawings														
			Erection drawings		G												
			Fabrication drawings	1.7.1	G												
			SD-03 Product Data														
			Shop primer	2.4													
			SD-06 Test Reports														
			Bolts, nuts, and washers	2.2													
			SD-07 Certificates														
			Steel	2.1													
			Bolts, nuts, and washers	2.2													
			Shop primer	2.4													
			Welding electrodes and rods	2.3.1													
			Nonshrink grout	2.3.2													
			AISC Quality Certification	1.5													

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	05120		Welding procedures and qualifications	1.7.2.2													
	05300a		SD-02 Shop Drawings														
			Deck Units	2.1													
			Accessories	2.5													
			Attachments	3.2													
			Holes and Openings	3.3													
			SD-03 Product Data														
			Deck Units	2.1													
			Attachments	3.2													
			SD-04 Samples														
			Deck Units	2.1													
			Accessories	2.5													
			SD-07 Certificates														
			Deck Units	2.1													
			Attachments	3.2													
	05500A		SD-02 Shop Drawings														
			Miscellaneous Metal Items	1.6													
			SD-04 Samples														
			Miscellaneous Metal Items	1.6													
	06100A		SD-02 Shop Drawings														
			Nailers and Nailing Strips	3.1.2													
			SD-07 Certificates														
			Insulation	2.3													
	07416A		SD-02 Shop Drawings														

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	07416A	Structural Standing Seam Metal Roof System			G RE												
		SD-03 Product Data															
		Design Analysis			G RE												
		Qualifications															
		SD-04 Samples															
		Accessories		2.3													
		Roof Panels		2.1													
		Factory Color Finish		2.5	G RE												
		Fasteners		2.4													
		Insulation		2.6													
		Gaskets and Insulating		2.9													
		Compounds															
		Sealant		2.8													
		Concealed Anchor Clips		2.2													
		EPDM Rubber Boots		2.11													
		SD-06 Test Reports															
		Test Report for Uplift Resistance of the SSSMR			G ED												
		SD-07 Certificates															
		Structural Standing Seam Metal Roof System															
		Insulation		2.6													
	07600a	SD-02 Shop Drawings															
		Materials		2.1													
		[], []															

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PART A R A G # A A P H	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION	ACTION		(m)	(n)	(o)	(p)		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		07900a	SD-03 Product Data														
			Backing	2.1													
			Bond-Breaker	2.2													
			Sealant	2.4													
			SD-07 Certificates														
			Sealant	2.4													
		08110	SD-02 Shop Drawings														
			Doors	2.1													
			Frames	2.5													
			Accessories	2.3													
			SD-03 Product Data														
			Doors	2.1													
			Frames	2.5													
			Accessories	2.3													
			SD-04 Samples														
			Factory-applied enamel finish	2.7.3	G R E												
		09650	SD-03 Product Data														
			Sheet Flooring	2.3													
			[], []														
			Accessories for Sheet Vinyl	2.3.3													
			Adhesive for Sheet Vinyl	2.3.2													
			Adhesive for Wall Base	2.2.2													
			SD-04 Samples														
			Sheet Flooring	2.3	G R E												
			Wall Base	2.5	G R E												
			SD-08 Manufacturer's Instructions														

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	09650	Tile Flooring															
		[], []															
		SD-10 Operation and Maintenance															
		Data															
		Data Package 1		G													
	09900	SD-02 Shop Drawings															
		Piping identification	3.7														
		stencil	3.7														
		SD-03 Product Data															
		Coating	2.1	G													
		Manufacturer's Technical Data	2.1														
		Sheets															
		[Sealant]															
		SD-04 Samples															
		Color	1.9	G													
		SD-07 Certificates															
		Applicator's qualifications	1.3														
		Qualification Testing	1.4.1.2	G													
		SD-08 Manufacturer's Instructions															
		Application instructions	3.2.1														
		Mixing	3.5.2														
		Manufacturer's Material Safety	1.7.2														
		Data Sheets															
		SD-10 Operation and Maintenance															
		Data															
		Coatings:	2.1	G													

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	10530	SD-02 Shop Drawings			G ED												
		Drawings															
		SD-03 Product Data			G ED												
		Design Analysis;															
		SD-04 Samples															
		Color			G RE												
		SD-07 Certificates															
		Canopy and Columns															
	11035	SD-02 Shop Drawings															
		Installation		3.3													
		SD-03 Product Data															
		Bullet Resistant Components		1.5													
		SD-07 Certificates															
		Bullet Resistant Components		1.5													
		SD-10 Operation and Maintenance															
		Data															
		Bullet Resistant Components		1.5	G												
	13121A	SD-02 Shop Drawings															
		Drawings			G RE												
		SD-03 Product Data															
		Manufacturer's Instructions															
		Qualifications		1.3.2	G RE												
		SD-07 Certificates															
		Metal Building Systems															
		Insulation		2.6													
	13798	SD-02 Shop Drawings															

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SECTION 01355

ENVIRONMENT PROTECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

The Contractor shall perform the work minimizing environmental pollution and damage as the result of construction operations. Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of land, water, and air, and includes management of visual aesthetics, noise, solid, chemical, gaseous, and liquid waste, radiant energy and radioactive materials, as well as other pollutants. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract.

1.1.1 Subcontractors

The Contractor shall ensure compliance with this section by subcontractors.

1.1.2 Environmental Protection Plan

The Contractor shall submit an environmental protection plan within 15 days after receipt of the notice to proceed. Approval of the Contractor's plan will not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures. The environmental protection plan shall include, but shall not be limited to, the following:

a. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

b. Methods for protection of features to be preserved within authorized work areas like trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archaeological, and cultural resources.

1.1.3 Permits

The Contractor shall obtain all needed permits or licenses. The Government will not obtain any permits for this project; see Contract Clause PERMITS AND RESPONSIBILITIES. The State department of natural resources, through the national pollutant discharge elimination system (NPDES), requires general permits, a notice of intent, and a notice of discontinuation. The Contractor shall be responsible for implementing the terms and requirements of the appropriate permits as needed and for payment of all fees.

Prior to commencement of the work the Contractor will:

- a) Apply for all permits required for this project.
- b) Submit a copy of each permit application to the Contracting Officer.

1.1.4 Preconstruction Survey

Prior to starting any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs and grassed areas immediately adjacent to work sites and adjacent to the assigned storage area and access routes as applicable. This report will be signed by both the Contracting Officer and the Contractor upon mutual agreement as to its accuracy and completeness.

1.1.5 Meetings

The Contractor shall meet with representatives of the Contracting Officer to alter the environmental protection plan as needed for compliance with the environmental pollution control program.

1.1.6 Notification

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the previously mentioned Federal, State or local laws or regulations, permits, and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action when approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspensions.

1.1.7 Litigation

If work is suspended, delayed, or interrupted due to a court order of competent jurisdiction, the Contracting Officer will determine whether the order is due in any part to the acts or omissions of the Contractor, or subcontractors at any tier, not required by the terms of the contract. If it is determined that the order is not due to Contractor's failing, such suspension, delay, or interruption shall be considered as ordered by the Contracting Officer in the administration of the contract under the contract clause SUSPENSION OF WORK.

1.1.8 Previously Used Equipment

The Contractor shall thoroughly clean all construction equipment previously used at other sites before it is brought into the work areas, ensuring that soil residuals are removed and that egg deposits from plant pests are not present; the Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements.

1.1.9 Payment

No separate payment will be made for work covered under this section; all costs associated with this section shall be included in the contract unit and/or lump sum prices in the Bidding Schedule.

1.2 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify the land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without permission. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, earth or other material displaced into uncleared areas shall be removed.

1.2.1 Work Area Limits

Prior to any construction, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

1.2.2 Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques.

1.2.3 Unprotected Erodible Soils

Earthwork brought to final grade shall be finished as indicated. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in cases where the constructed feature obscures borrow areas, quarries, and waste material areas, these areas shall not initially be totally cleared. Clearing of such areas shall progress in reasonably sized increments as needed to use the developed areas as approved by the Contracting Officer.

1.2.4 Disturbed Areas

The Contractor shall effectively prevent erosion and control sedimentation through approved methods including, but not limited to, the following:

- a. Retardation and control of runoff. Runoff from the construction site or from storms shall be controlled, retarded, and diverted to protected drainage courses by means of diversion ditches, benches, berms, and by any measures required by area wide plans under the Clean Water Act.

b. Erosion and sedimentation control devices. The Contractor shall construct or install temporary and permanent erosion and sedimentation control features as indicated on the drawings. Berms, dikes, drains, sedimentation basins, grassing, and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.

c. Sediment basins. Sediment from construction areas shall be trapped in temporary or permanent sediment basins in accordance with the drawings. The basins shall accommodate the runoff of a local 5 year storm. After each storm, the basins shall be pumped dry and accumulated sediment shall be removed to maintain basin effectiveness. Overflow shall be controlled by paved weirs or by vertical overflow pipes. The collected topsoil sediment shall be reused for fill on the construction site, and/or stockpiled for use at another site. The Contractor shall institute effluent quality monitoring programs as required by State and local environmental agencies.

1.2.5 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Borrow areas shall be managed to minimize erosion and to prevent sediment from entering nearby waters. Spoil areas shall be managed and controlled to limit spoil intrusion into areas designated on the drawings and to prevent erosion of soil or sediment from entering nearby waters. Spoil areas shall be developed in accordance with the grading plan indicated on the drawings. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas from despoilment.

1.3 WATER RESOURCES

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation when such application may cause contamination of the fresh water reserve. Monitoring of water areas affected by construction shall be the Contractor's responsibility. All water areas affected by construction activities shall be monitored by the Contractor.

1.3.1 Washing and Curing Water

Waste waters directly derived from construction activities shall not be allowed to enter water areas. Waste waters shall be collected and placed in retention ponds where suspended material can be settled out or the water evaporates to separate pollutants from the water. Analysis shall be performed and results reviewed and approved before water in retention ponds is discharged.

(A) Wild Life Encounters During Construction:

It is not anticipated that there will be an abundance of wild life encounters at the project site. However, should the Contractor discover animals living within the construction boundaries, operation shall be suspended at the site of discovery and continued in other areas. The Contractor shall notify the Contracting Officer and Biological Monitor immediately of the finding. Included with the notification shall be a brief statement to the Contracting Officer and Biological Monitor of the location and the findings. How to identify sensitive animals that may be discovered will be provided at the Preconstruction Conference.

(B) Desert Tortoise:

Contractor employees shall not touch, harm, harass, or kill desert tortoises. The Biological Monitor shall be notified immediately of all desert tortoise sightings. The Biological Monitor will be responsible for removing desert tortoises out of immediate dangers. Should construction activities threaten the survival of any desert tortoises, those activities will immediately cease until the Biological Monitor safely removes the tortoise(s). The Biological Monitor shall perform clearance surveys in all areas of planned disturbance. The Biological Monitor will be available to accompany construction crews during period of tortoise activity to provide protection of these animals and their burrows.

(1) The Contractor shall implement an employees environmental awareness program which will be provided to construction and operation employees with information to encourage awareness and preservation of the desert ecosystem and the resources found in the **Western Mojave Desert**. This information shall be distributed to and discussed with all employees during employee orientation sessions. This information shall also be provided to all visitors and subcontractors that will be on-site. The Contractor shall have all persons participating in the environmental awareness program sign and affidavit declaring that the individual understands and will adhere to the guidelines set forth in the program material.

(2) The Contractor shall develop a strict trash and litter control program. A litter control program shall consist of supplying an adequate number of covered trash and litter receptacles in all appropriate locations.

1.3.2 Protection of Endangered Trees:

(A) Endangered Trees within Project Site:

Due to the limited vegetation in the area, removal or relocation of plants shall be minimized. The Contractor shall obtain approval from the Contracting Officer before removing or relocating any endangered plants within the construction boundaries. One such plant is the Joshua Tree which is an endangered species. How to identify this tree and procedures for relocating those within the project site, are described as follows:

(B) Joshua Trees:

Only trees under 5 feet tall shall be moved using hand tools. Mark North side of the tree and plant in same orientation. Using shovel, dig down to get main root mass (generally within 2 feet of surface). Try to get tap root and a fibrous water storage structure that it leads to. Take some of the soil to put in new hole. Roots should be dusted with sulfur to prevent rot. A small amount of manure can be mixed in with soil when replanting. Soil should be tamped down and a small berm placed around plant 5-foot diameter. Water with several gallons. Stake in 2 directions to prevent wind from knocking down. If not transplanted right away, "heel in" the plant (lay them on their side and cover roots with soil). Very large Joshua Trees (10-20 feet tall) shall not be moved but be detoured around by the utilities. If plants need relocation areas, they can be used in landscaping around the base.

1.4 AIR RESOURCES

Equipment operation and activities or processes performed by the Contractor in accomplishing the specified construction shall be in accordance with the State's rules and all Federal emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency shall be maintained. Monitoring of air quality shall be the Contractor's responsibility. All air areas affected by the construction activities shall be monitored by the Contractor. Monitoring results will be periodically reviewed by the Government to ensure compliance.

1.4.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

1.5 WASTE DISPOSAL

Disposal of wastes shall be as specified below.

1.5.1 Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal.

1.5.2 Chemical Wastes

Chemicals shall be dispensed ensuring no spillage to ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste shall be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 150 mm (6 inches) of the top. Wastes shall be disposed of in accordance with Federal and local laws and regulations.

1.5.3 Hazardous Wastes

The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing and shall collect waste in suitable containers observing compatibility. The Contractor shall transport hazardous waste off Government property and dispose of it in compliance with Federal and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Contracting Officer. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility.

1.5.4 Burning Rubbish and Debris:

Open burning of rubbish, debris and other combustibles will not be permitted on the Fort.

1.5.5 Soil Waste

Excess and/or unsatisfactory soil, including clearing debris, shall be disposed of off the installation at the Contractor's expense in compliance with all Federal, State and local regulations.

1.6 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Existing historical, archaeological, and cultural resources within the Contractor's work area will be so designated by the Contracting Officer if any has been identified. The Contractor shall take precautions to preserve all such resources as they existed at the time they were first pointed out. The Contractor shall provide and install protection for these resources and be responsible for their preservation during the life of the contract. If during excavation or other construction activities any previously unidentified or unanticipated resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer. While waiting for instructions the Contractor shall record, report, and preserve the finds.

1.7 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction.

1.8 RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work areas.

1.9 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

1.10 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental pollution control.

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SECTION 01451

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1077	(1996) Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 3666	(1996) Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials
ASTM D 3740	(1996) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(1995b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with quality requirements specified in the contract. The project superintendent in this context shall mean the individual with the responsibility for the overall management of the project including quality and production.

3.2 QUALITY CONTROL PLAN

3.2.1 General

The Contractor shall furnish for review by the Government, not later than 15 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 60 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.2 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01330 SUBMITTAL PROCEDURES.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 14 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure contract compliance. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer.

3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within his organization at the site of the work who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall have a minimum of 5 years in CQC field. This CQC System Manager shall be on the site at all times during construction and will be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager will be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate will be the same as for the designated CQC System Manager.

3.4.3 Additional Requirement

In addition to the above experience and or education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management For Contractors". This course is offered quarterly by the Los Angeles District, contact the Contracting Officer for more information.

3.4.4 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. Specialized personnel, as defined in Paragraph 3.4.3 above, must be reasonably available if not physically present. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals and deliverables are in compliance with the contract requirements.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

a. A review of each paragraph of applicable specifications, reference codes, and standards. A copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field shall be made available by the Contractor at the preparatory inspection. These copies shall be maintained in the field and available for use by Government personnel until final acceptance of the work.

b. A review of the contract drawings.

c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

g. A review of the appropriate activity hazard analysis to assure safety requirements are met.

h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

j. Discussion of the initial control phase.

k. The Government shall be notified at least 48 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government shall be notified at least 48 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of an independent commercial laboratory that has been approved by the Resident Engineer. In addition, the laboratory shall be submitted as part of the Contractor's Quality Control Plan and approved by the Contracting Officer. The Contractor shall perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph

reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

3.7.2.1 Capability Check

The Contractor shall use an independent commercial laboratory that has been inspected by the AASHTO Materials Reference Laboratory (AMRL) or the Cement and Concrete Reference Laboratory (CCRL), as applicable, for the required test methods. The inspection report(s) and the written response(s) to any noted deficiencies shall be included with the Contractor Quality Control Plan and will be subject to approval by the Resident Engineer. Laboratories utilized for testing soils, concrete, asphalt, or steel shall meet the applicable requirements of ASTM D 3740, C 1077, D3666 and E 329.

3.7.2.2 Quality Assurance Check

The Government reserves the right to perform a quality assurance check of the laboratory equipment and procedures.

3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the QA laboratory designated by the Contracting Officer.

Coordination for each specific test, exact delivery location and dates will be made through the Area Office.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the Special Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications, the CQC Manager shall conduct an inspection of the work. A punch list of items which do not conform to the approved drawings and specifications shall be prepared and included in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from U.S. Border Patrol user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase shall be identified (Preparatory, Initial, Follow-up). List deficiencies noted, along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.
- g. Off-site surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

3.10 CONSTRUCTION CONTROL MANUAL

In addition to the requirements specified in the various Technical Specifications hereinafter, test procedures and minimum number of tests will be performed in accordance with SPK PAM 415-1-2, "Construction Control Manual". Neither the specified minimum number of tests nor the lack of them shall in any way limit or relieve the Contractor of his responsibility to perform adequate tests to assure compliance with the quality requirements of these specifications. The referenced standards listed in this Construction Control Manual shall be of the latest issue unless otherwise specified.

The "Construction Control Manual" may be examined in the following office locations, and will be furnished to the Contractor:

Corps of Engineers
Los Angeles District
Construction Management Section
911 Wilshire Blvd.
Los Angeles, California

Corps of Engineers
Fort Irwin Resident Office
Corner of 5th Street and F Avenue
Fort Irwin, California

3.11 JOINT INSPECTION DURING WARRANTY PERIOD

The government will perform this inspection at the 4th and 9th month after project acceptance by the customer. The Contractor's CQC System Manager and/or primary management person, the Contracting Officer's Representative, and the Building Manager (customer) shall be in attendance at this inspection. Additional Government personnel, including but not limited to those from the post Directorate of Public Works user groups and Major Commands, may also be in attendance. This joint inspection will be formally scheduled by the Contracting Officer. For additional warranty requirements, see FAR 52.246-21, Warranty of Construction (Mar 1994).

-- End of Section --

(Sample of typical Contractor's Test Report)

TEST REPORT

STRUCTURAL OR BUILDING

CONTRACT NO.

DESCRIPTION OF ITEM, SYSTEM OR PART OF SYSTEM TESTED:

DESCRIPTION OF TEST:

NAME AND TITLE OF PERSON IN CHARGE OF PERFORMING TESTS FOR CONTRACTOR:

NAME

TITLE

SIGNATURE

I HEREBY CERTIFY THAT THE ABOVE DESCRIBED ITEM, SYSTEM OR PART OF SYSTEM HAS BEEN TESTED AS INDICATED ABOVE AND FOUND TO BE ENTIRELY SATISFACTORY AS REQUIRED IN THE CONTRACT SPECIFICATIONS.

SIGNATURE OF CONTRACTOR QUALITY CONTROL INSPECTOR
DATE

REMARKS:

(Sample of Typical DAILY CONSTRUCTION QUALITY CONTROL REPORT)

CONTRACTOR'S NAME
(Address)

DAILY CONSTRUCTION QUALITY CONTROL REPORT

Date: _____ Report No. _____

Contract No.: _____

Name and Location of Project: _____

WEATHER: (Clear) (P. Cloudy) (Cloudy) Temperature: _____

Rainfall _____ Inches Min., _____ Max., _____

Contractor/Subcontractors

Area of Responsibility

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____
- g. _____

1. WORK PERFORMED TODAY: (Indicate location and description of work performed. Refer to work performed by prime and/or subcontractors by letter in Table above.)

2. PREPARATORY INSPECTION FOR NEXT ITEM OF WORK: (Materials/shop drawings approved, required control testing arranged, all preliminary work has been accomplished as per plans and specifications.)

3. INITIAL INSPECTION: (Address quality of workmanship, assure control testing and materials being used in all work are in compliance with plans and specifications).

4. FOLLOW-UP INSPECTIONS: (Assure control testing performed as required and all work performed continues to be in compliance with plans and specifications).

5. VERBAL INSTRUCTIONS RECEIVED: (List any instructions given by Government personnel on construction deficiencies, retesting required, etc., with action to be taken.)

6. REMARKS: (Cover any conflicts in plans, specifications, or instructions or any delay to the job attributable to weather conditions.)

7. RESULTS OF SAFETY INSPECTION: (Note safety violations and corrective action taken. Indicate phase of work where violations occurred.)

8. UPCOMING WORK: (Indicate next major phase of work anticipated and approximate date of Preparatory Inspection meeting to cover this work.)

EQUIPMENT DATA: (Indicate items of construction equipment, other than hand tools, at the job site and whether or not used.)

CONTRACTOR'S VERIFICATION: The above report is complete and correct and all material and equipment used and work performed during this reporting period area in compliance with the contract plans and specifications except as noted above.

—

Contractor's Approved/Authorized
Representative

(Sample of Typical Form)

PREPARATORY INSPECTION OUTLINE
(PART-I)

Contract No.: _____ Date:

Title and No. of Technical Section:

Reference Contract Drawings:

A. PLANNED ATTENDANTS:

	<u>NAME</u>	<u>POSITION</u>	<u>COMPANY</u>
1.			
2.			
3.			
4.			

B. SUBMITTALS REQUIRED TO BEGIN WORK:

	<u>ITEM</u>	<u>SUBMITTAL NO.</u>	<u>ACTION CODE</u>
a.			
b.			
c.			
d.			

I HEREBY DECLARE THAT THE ABOVE REQUIRED MATERIALS DELIVERED TO THE JOBSITE ARE CERTIFIED TO BE THE SAME AS THOSE SUBMITTED AND APPROVED.

QUALITY CONTROL REPRESENTATIVE

C. EQUIPMENT TO BE USED IN EXECUTING WORK:

- a.
- b.
- c.

D. WORK AREAS EXAMINED TO ASCERTAIN THAT ALL PRELIMINARY WORK HAS BEEN COMPLETED:

E. METHODS AND PROCEDURES FOR PERFORMING QUALITY CONTROL - INCLUDING SPECIFIC TESTING REQUIREMENTS:

F. COMPLIANCE WITH AND UPGRADING OF THE SAFETY PLAN AND ACTIVITY HAZARD ANALYSIS INCLUDING REVIEW OF THE ACTIVITY ANALYSIS WITH EACH WORKER:

THE ABOVE METHODS AND PROCEDURES OUTLINED ARE CERTIFIED TO COMPLY WITH THE CONTRACT REQUIREMENTS AND WILL BE PERFORMED AS PLANNED AND SPECIFIED.

QUALITY CONTROL REPRESENTATIVE

(Sample of Typical Form)

PREPARATORY INSPECTION OUTLINE
(PART - II)

A. PERSONS IN ATTENDANCE:

	<u>NAME</u>	<u>POSITION</u>	<u>COMPANY</u>
1.			
2.			
3.			
4.			
5.			
6.			

B. ITEMS OF MUTUAL UNDERSTANDING DEVELOPED DURING REVIEW OF PREPARATORY OUTLINE AND CONTRACT REQUIREMENTS: (Contract items not specifically covered during the preparatory inspection conference are assumed to be in strict conformance with the contract requirements.)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

THE ITEMS NOTED ABOVE CONSTITUTE A MEMORANDUM OF MUTUAL UNDERSTANDING AND WILL BE PERFORMED AS PLANNED AND SPECIFIED.

CONTRACTOR'S APPROVED/AUTHORIZED REPRESENTATIVE

(Sample of Typical Form)

INITIAL PHASE CHECK LIST

Contract No.: _____ Date:

Specification Paragraph or Section:

Description and Location of Work Inspected:

REFERENCE CONTRACT DRAWINGS:

A. PERSONNEL PRESENT:

	<u>NAME</u>	<u>POSITION</u>	<u>COMPANY</u>
1.			
2.			
3.			
4.			

B. MATERIALS BEING USED ARE IN STRICT COMPLIANCE WITH THE CONTRACT PLANS AND SPECIFICATIONS: YES _____ NO _____

IF NOT, EXPLAIN:

C. PROCEDURES AND/OR WORK METHODS WITNESSED ARE IN STRICT COMPLIANCE WITH THE CONTRACT SPECIFICATIONS: YES _____ NO _____

IF NOT, EXPLAIN:

D. WORKMANSHIP IS ACCEPTABLE: YES _____ NO _____

STATE AREAS WHERE IMPROVEMENT IS NEEDED:

E. SAFETY VIOLATIONS NOTED: YES _____ NO _____

IF YES, CORRECTIVE ACTION TAKEN:

QUALITY CONTROL REPRESENTATIVE

INDEX

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

PARAGRAPH

PART 1 GENERAL

- 1.1 APPLICABLE PUBLICATIONS
- 1.2 GENERAL REQUIREMENTS
- 1.3 AVAILABILITY AND USE OF UTILITY SERVICES
- 1.4 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN
- 1.5 PROTECTION AND MAINTENANCE OF TRAFFIC
- 1.6 CONTRACTOR'S TEMPORARY FACILITIES
- 1.7 HOUSEKEEPING AND CLEANUP
- 1.8 RESTORATION OF STORAGE AREA

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 APPLICABLE PUBLICATIONS:

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1983) Construction and Industrial
Plywood

DOC PS 20 (1970) American Softwood Lumber Standard.

FEDERAL SPECIFICATIONS (FS)

FS TT-E-2784 (Rev A) Enamel (Acrylic-Emulsion, Exterior)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z535.1 (1991) Safety Color Code

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM F 547 (1977; R 1990) Definitions of Terms Relating
to Nails for Use with Wood and Wood-Base
Materials

U.S. ARMY CORPS OF ENGINEERS

EM 385-1-1 Safety and Health Requirements Manual
(3 September 1996).

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 16 (1970; Rev 1983) Standard Grading and
Dressing Rules for Douglas Fir, Western
Hemlock, Western Red Cedar, White Fir,
Sitka Spruce Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01 (1991; Supple No. 1) Western Lumber
Grading Rules 91

1.2 GENERAL REQUIREMENTS

1.2.1 Site Plan

The Contractor shall prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Any areas which may have to be graveled to prevent the tracking of mud shall also be identified. The Contractor shall also indicate if the use of a supplemental or other staging area is desired.

1.2.2 Identification of Employees

The Contractor shall be responsible for furnishing to each employee and for requiring each employee engaged on the work to display identification as approved and directed by the Contracting Officer. Prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of any employee. When required, the Contractor shall obtain and provide fingerprints of persons employed on the project. Contractor and subcontractor personnel shall wear identifying markings on hard hats clearly identifying the company for whom the employee works.

1.2.3 Employee Parking

Contractor employees shall park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking shall not interfere with existing and established parking requirements of the military installation.

1.3 AVAILABILITY AND USE OF UTILITY SERVICES

1.3.1 Payment for Utility Services

The Government will make all reasonably required utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The Contractor shall provide meters and is responsible for payment of all utility services. The Contractor's attention is directed to Section 00800, Paragraph AVAILABILITY OF UTILITIES SERVICES.

1.3.2 Sanitation

The Contractor shall provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

1.3.3 Telephone

The Contractor shall make arrangements and pay all costs for telephone facilities desired.

1.4 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.4.1 Bulletin Board

Immediately upon beginning of work, the Contractor shall provide a weatherproof glass-covered bulletin board not less than 915 by 1220 mm (36 by 48 inches) in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work the bulletin board shall be removed by and remain the property of the Contractor.

1.4.2 Project and Safety Signs

(A) General:

The Contractor shall construct and erect one project sign, one safety sign and a minimum of 1 hard hat signs at locations designated by the Contracting Officer. The signs shall conform to the requirements of the drawings attached at the end of this section. The signs shall be erected as soon as possible and within 15 days after date of commencement of work under this contract. The data required by the safety sign shall be corrected daily.

(B) Materials:

(1) Lumber shall conform to DOC PS 20 and grading rules of applicable grading agencies, WCLIB or WWP. Grade shall be "Standard" or better Douglas Fir, S4S and shall be stamped S-Dry.

(2) Plywood: Plywood shall conform to DOC PS 1, Grade AC, Group 1, Exterior.

(3) Bolts, Nuts and Nails: Bolts and nuts shall be galvanized, and type, and size best suited for intended for use. Nails shall conform to ASTM F 547.

(4) Paint: Type of paint for primer, finish coats, and lettering, shall be as indicated on the attached standard drawing, Project Sign, paragraph PAINTING. The color of signs and lettering shall be as directed by the Contracting Officer. Safety signs shall be painted in the same colors as the project sign. Hard hat signs shall be painted as indicated on the attached drawing.

(5) Decals: Corps of Engineers castle decal and the hard hat decal called for on the signs will be furnished by the Government.

(C) Construction:

(1) Signs shall be constructed as detailed on attached drawings.

(2) Painting: All exposed surfaces and edges of plywood shall be given one coat of linseed oil and be wiped prior to applying primer. All exposed surfaces of signs and supports shall be given one coat of primer and one finish coat as indicated. All lettering shall be sized as indicated. Width of letter stroke shall be 1/6 of the letter height, except as noted.

(D) Maintenance and Disposal:

The Contractor shall maintain the signs in good condition throughout the life of the project. Signs shall remain the property of the Contractor and upon completion of the project they shall be removed from the site.

1.5 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic. The Contractor shall maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

1.5.1 Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. The Contractor shall provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Upon completion of the work, haul roads designated by the Contracting Officer shall be removed.

1.5.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

1.6 CONTRACTOR'S TEMPORARY FACILITIES

1.6.1 Administrative Field Offices

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

1.6.2 Storage Area

The Contractor shall construct a temporary 1.8 meter (6 foot) high chain link fence around trailers and materials. The fence shall include plastic strip inserts, colored brown, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the Government boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. At the end of each work day mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area.

1.6.3 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the Government boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

1.6.4 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on the Government property.

1.6.5 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse with construction equipment or other vehicles grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

1.6.6 Security Provisions

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

1.7 HOUSEKEEPING AND CLEANUP:

Pursuant to the requirements of paragraph, CLEANING UP and paragraph, ACCIDENT PREVENTION, of the CONTRACT CLAUSES, Section 00700, the Contractor shall assign sufficient personnel to insure strict compliance. The Contractor shall submit a detailed written plan for implementation of this requirement. The plan will be presented as part of the preconstruction safety plan and will provide for keeping the total construction site, structures and accessways free of debris and obstructions at all times. Work will not be allowed in those areas that, in the opinion of the Contracting Officer's representative, have unsatisfactory cleanup and housekeeping at the end of the preceding day's normal work shift. At least once each day all areas shall be checked by the Quality Control person of the Prime Contractor and the findings recorded on the Quality Control Daily Report. In addition, the Quality Control person will take immediate action to insure compliance with this requirement. Housekeeping and cleanup shall be assigned by the Contractor to specific personnel. The name(s) of the personnel shall be available at the project site; each person will be supplied with a distinctively marked hard hat, to be worn from the beginning to the end of the project.

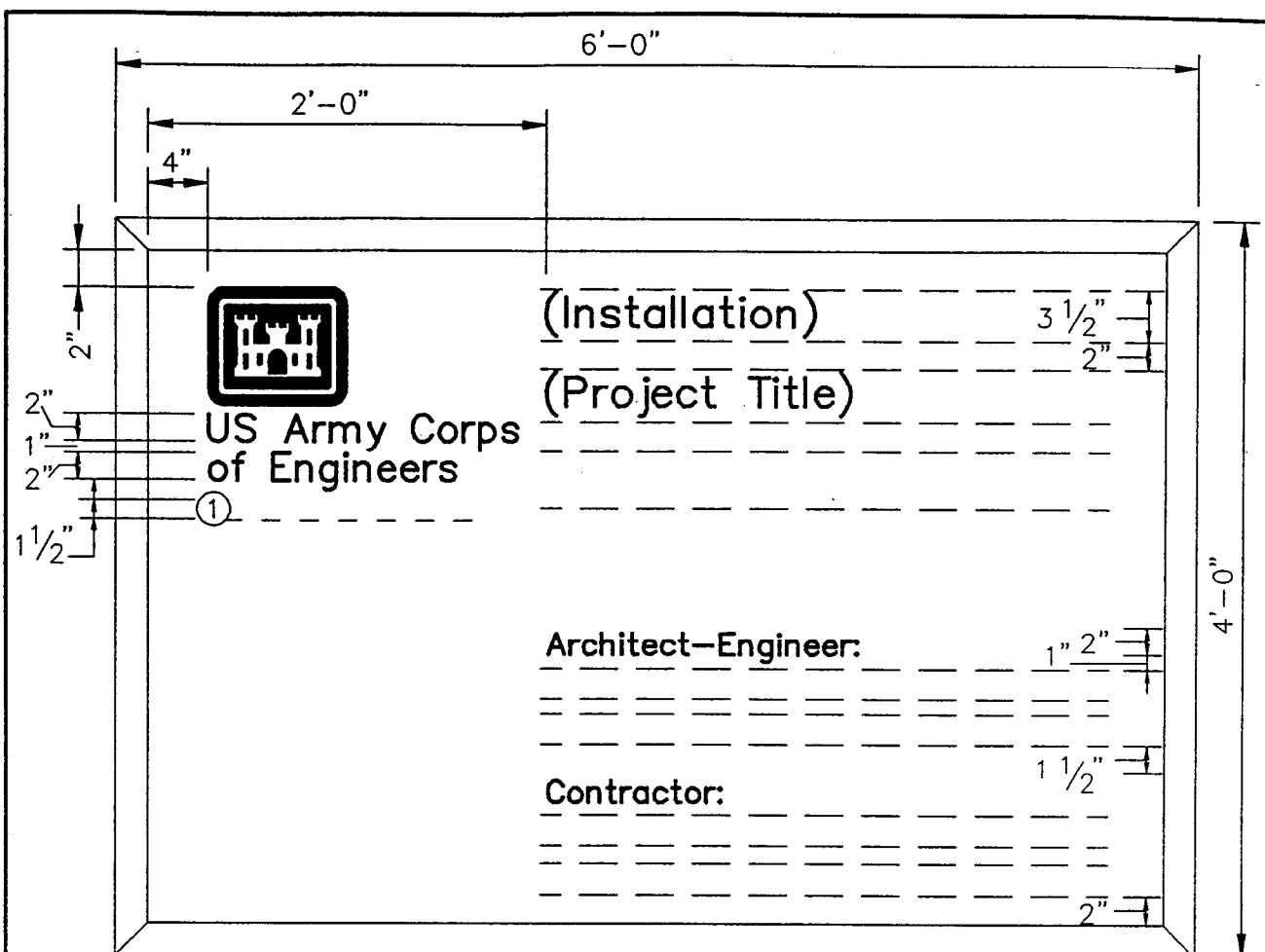
1.8 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --



① "[insert construction district name] DISTRICT"

SIGN MATERIALS

POST 4" X 4" X 3/4" EXTERIOR PLYWOOD 4'-0" X 6'-0" X 1"X2" FRAMING WITH MITERED CORNERS. EDGES OF PLYWOOD SHALL BE SEALED PRIOR TO PAINTING.

PAINTING

COLORS SHALL BE AS DIRECTED BY THE CONTRACTING OFFICER. ALL SURFACES SHALL BE GIVEN ONE COAT OF EXTERIOR PAINT MEETING FS TT-E-2784, TYPE III, (FLAT) AND ONE COAT OF EXTERIOR ENAMEL PAINT MEETING FS TT-E-2784, TYPE II (SEMI-GLOSS). ALL PAINTED LETTERING SHALL BE EXTERIOR PAINT MEETING FS TT-E-2784, TYPE II (SEMI-GLOSS). THE CASTLE INSIGNIA WILL BE FURNISHED BY THE GOVERNMENT IN PRESSURE SENSITIVE VINYL FOR AFFIXING BY THE CONTRACTOR.

LETTERING

ALL LETTERING IS TO BE HELVETICA BOLD OR HELVETICA MEDIUM. LETTERING SIZES SHALL BE DETERMINED BY THE AMOUNT OF INFORMATION TO BE PRINTED ON THE SIGN, NO LETTERING HEIGHT SHALL EXCEED THE SIZE SPECIFIED. ALL INFORMATION IS TO BE LAID OUT AS SHOWN.

PROJECT SIGN

STANDARD DETAIL
PROJECT SIGN
U S ARMY
U S ARMY ENGINEER DISTRICT
SACRAMENTO

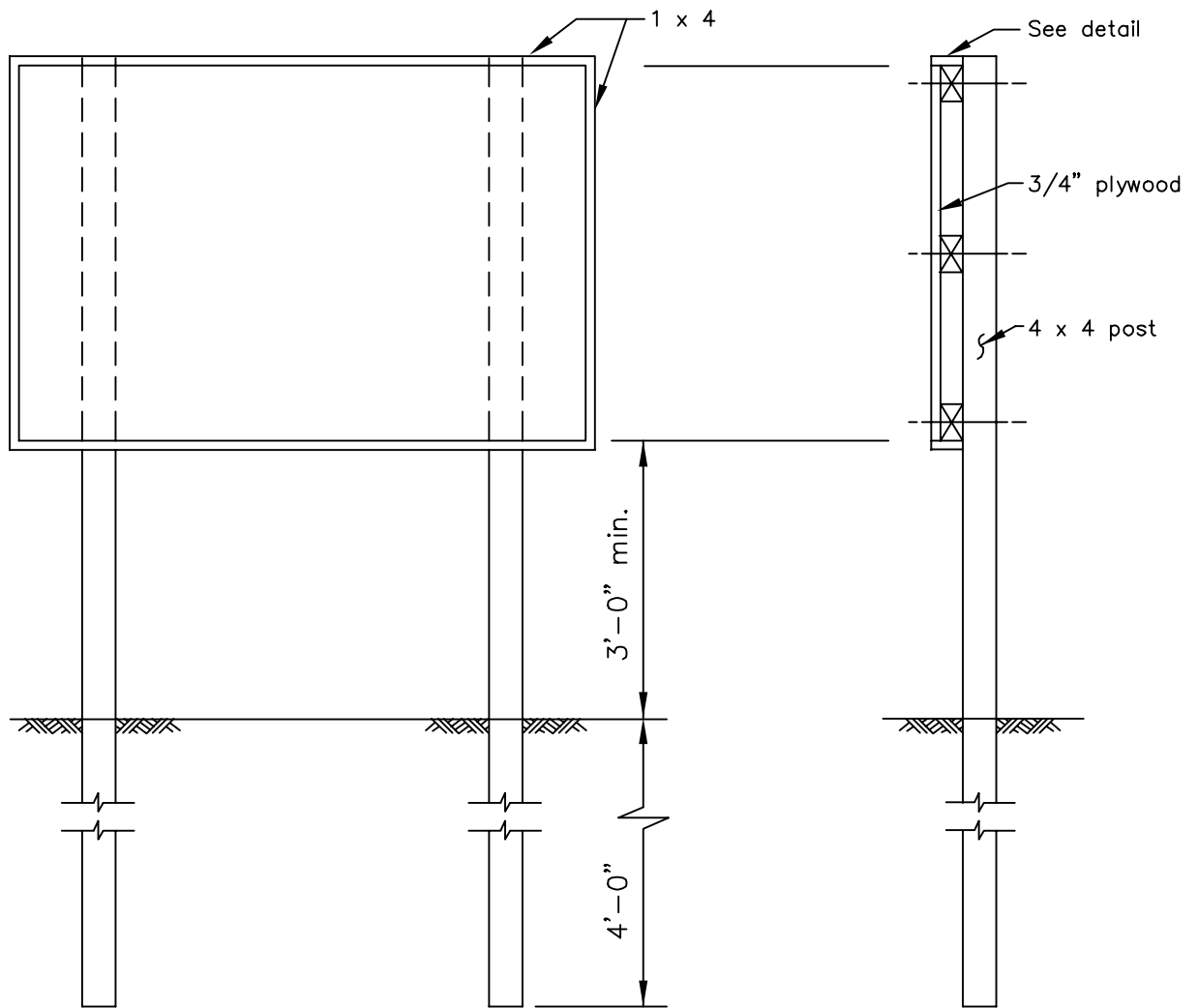
Drawn T. Tufts

Not to Scale

Checked R. Simmons

NOVEMBER 1993

File No. 150-25-1186

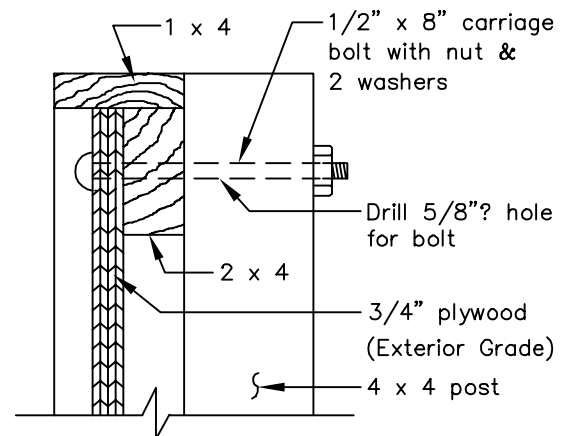


ELEVATION

SECTION

GENERAL NOTES:

1. Lumber to be cut & formed accurately.
2. Secure 1 x 4 and plywood with 6d finish nails at not less than 12" O.C.
3. All exposed nails to be set & holes filled with putty.
4. Sign to be set in good solid ground & backfill carefully tamped into place.
5. Where necessary posts shall be braced to provide a solid installation.
6. Paint primer (Fed. Spec. TT-P-25)
Paint primer (Fed. Spec. TT-E-529)



DETAIL

STANDARD DETAIL
SIGN DETAILS

U.S. ARMY ENGINEER DISTRICT
SACRAMENTO

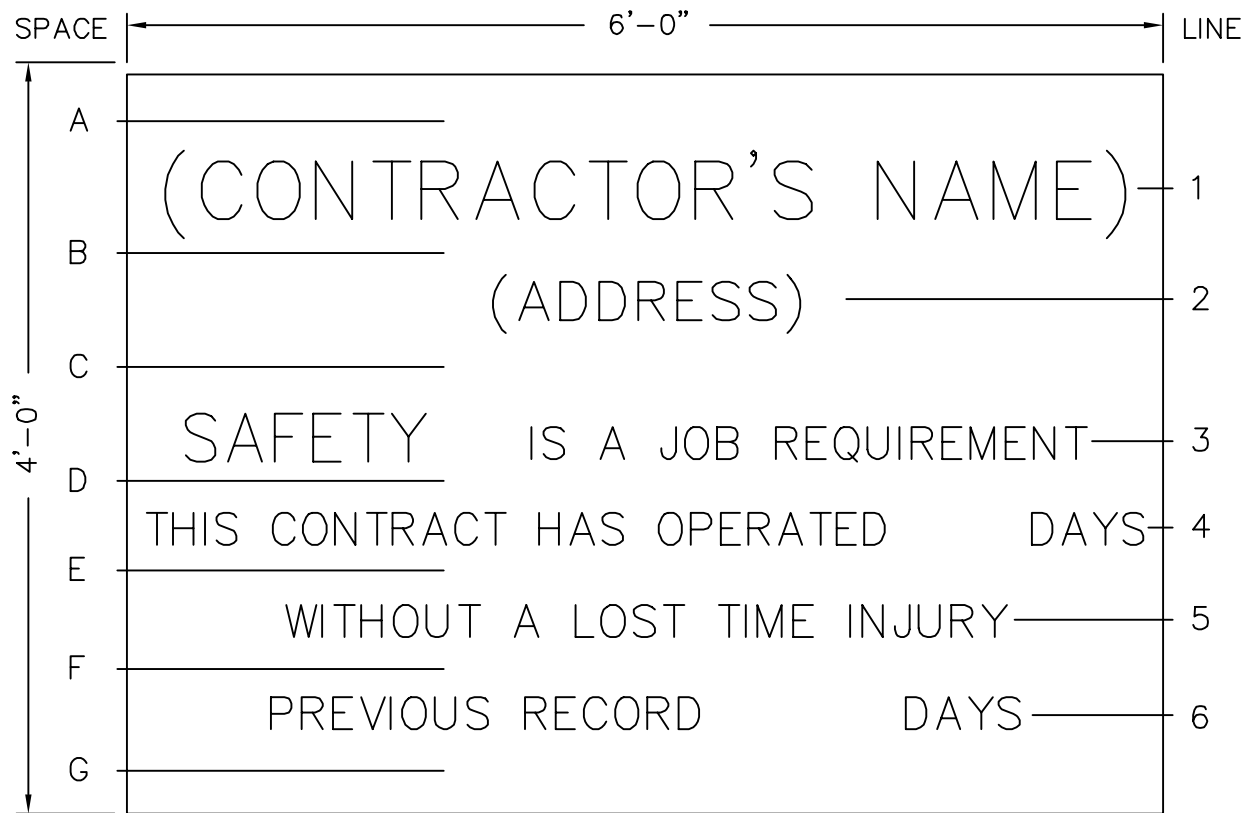
Drawn M.Koenig

Not to Scale

Checked R. Simmons

1987

File No. 150-25-1232



SCHEDULE

<u>SPACE</u>	<u>HEIGHT</u>	<u>LINE</u>	<u>DESCRIPTION</u>	<u>LETTER HEIGHT</u>
A	5"	1	CONTRACTOR'S NAME	5"
B	3"	2	ADDRESS	3"
C	6"	3	SAFETY IS A JOB REQUIREMENT	4 1/2" & 3"
D	3"	4	ALL LETTERING	3"
E	3"	5	ALL LETTERING	3"
F	3"	6	ALL LETTERING	3"
G	5"			

NOTE:

LETTERING SHALL BE BLACK No. 27038, FEDERAL STANDARD 595A.
SIGN SHALL BE INSTALLED IN THE SAME MANNER
AS THE PROJECT SIGN.

STANDARD DETAIL

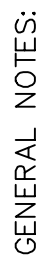
SAFETY SIGN

U S ARMY ENGINEER DISTRICT
SACRAMENTO

Drawn T. Tufts Not to Scale

Checked R. Simmons AUG. 1988

File number 80-25-707



1. Green & White Paint shall be opaque glossy as specified in ANSI Z535.1
2. Bolt Slgn to post w/2½" dia. Carriage Bolts.

STANDARD DETAIL
HARD HAT SIGN
U.S. ARMY ENGINEER DISTRICT
SACRAMENTO
Drawn T. Tufts Not to Scale
Checked R. Simmons JAN. 1996
File No. 80-25-774

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SECTION 01505

GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SCRAP MATERIAL

Materials specified to be removed and become the property of the Contractor are designated as scrap, and the Contractor, by signing this contract, hereby acknowledges that he has made due allowance for value, if any, of such scrap in the contract price.

All scrap, solid waste, or hazardous materials (to be reused by the contractors) shall be disposed of and removed, in accordance with applicable laws and regulations at Contractor's expense, unless otherwise specified in the contract.

1.2 WRITTEN GUARANTEES AND GUARANTOR'S LOCAL REPRESENTATIVE

Prior to completion of the contract, the Contractor shall obtain and furnish to the Contracting Officer's representative written guarantees for all the equipment and/or appliances furnished under the contract. The Contractor shall furnish with each guarantee: The name, address, and telephone number of the guarantor's representative nearest to the location where the equipment and/or appliances are installed, who, upon request of the Using Service's representative, will honor the guarantee during the guaranty period and will provide the services prescribed by the terms of the guarantee.

1.3 PRICING OF CONTRACTOR-FURNISHED PROPERTY

The Contractor shall promptly furnish and shall cause any sub-contractor or supplier to furnish, in like manner, unit prices and descriptive data required by the Government for Property Record purposes of fixtures and equipment furnished and/or installed by the Contractor or sub-contractor, except prices do not need to be provided for Government-Furnished Property. This information shall be listed on RMS CQC Module furnished by the Government. See example forms at the end of this section.

1.4 TEMPORARY ELECTRIC WIRING

1.4.1 Temporary Power and Lighting

The Contractor shall provide construction power facilities in accordance with the safety requirements of the National Electrical Code NFPA No. 70 and the SAFETY AND HEALTH REQUIREMENTS MANUAL EM 385-1-1. The Contractor, or his delegated subcontractor, shall enforce all the safety requirements of electrical extensions for the work of all subcontractors. All work shall be accomplished by skilled electrical tradesmen in a workmanlike manner, as approved by the Contracting Officer.

1.4.2 Construction Equipment

In addition to the requirements of EM 385-1-1, SAFETY AND HEALTH REQUIREMENTS MANUAL, all temporary wiring conductors installed for operation of construction tools and equipment shall be either Type TW or THW contained in metal raceways, or may be multiconductor cord. Temporary wiring shall be secured above the ground or floor in a workmanlike manner and shall not present an obstacle to persons or equipment. Open wiring may only be used outside of buildings, and then only in strict accordance with the provisions of the National Electrical Code.

1.4.3 Circuit Protection

In addition to the present requirements in EM 385-1-1 and the National Electrical Code, all 15 and 20-ampere receptacle outlets used for obtaining power during construction shall have ground fault circuit interrupters (GFCI) for personnel protection. Block and brick saws shall also be equipped with GFCI. The Contracting Officer may allow an exception to this requirement for circuits for concrete vibrators or circuits operating at other than 60 Hertz normal (in both cases an assured grounding program as described in the National Electrical Code, except utilizing the daily inspection frequency of the grounding means of such equipment, may be permitted). The assured grounding program will not be permitted as a substitute for usage of GFCI'S except as described above. All generator-powered 15- and 20-ampere, 60 Hertz receptacle outlets shall have GFCI'S, and shall be properly grounded. A testing means shall be provided which will impose a measured fault of 5 milliamperes, plus or minus 1 milliamperes, and result in tripping the GFCI unit.

1.5 UTILITIES

If the Contractor encounters, within the construction limits of the entire project, utilities not shown on the plans and not visible as to the date of this contract and such utilities will interfere with construction operations, he shall immediately notify the Contracting Officer in writing to enable a determination by the Contracting Officer as to the necessity for removal or relocation. If such utilities are removed or relocated as directed by the Contracting Officer, the Contractor shall be entitled to equitable adjustment for any additional pertinent work or delay.

1.6 GENERAL SAFETY REQUIREMENTS

1.6.1 General

The Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, (see Contract Clauses, Section 00700, ACCIDENT PREVENTION) and the Occupational Safety and Health Act (OSHA) Standards for Construction (Title 29, Code of Federal Regulations Part 1926 as revised from time to time); General Industry Standards (Title 29, Code of Federal Regulations Part 1910 as revised from time to time); and the National Fire Protection Association Codes are applicable to this contract. In case of conflict the most stringent requirement of the standards is applicable.

(2) The Army Safety Program, AR 385-10; U.S. Army Explosive Safety Program (DRAFT), AR 385-64; U.S. Army Ammunition and Explosives Safety Standards, (DRAFT) DA PAM 385-64; Sierra Army Depot Safety Manual, SIAD Reg 385-1; Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, (see Contract Clauses, Section 00700, ACCIDENT PREVENTION) and the Occupational Safety and Health Act (OSHA) Standards for Construction are applicable to this contract. In case of conflict the most stringent requirement of all standards is applicable.

1.6.2 The Prime Contractor's Superintendent

The Prime Contractor's superintendent shall take an active role in enforcing the safety requirements by participation in safety conferences, hazard analysis (see below), tool box meetings, walk-through inspections, correction of violations, etc., and including that of the subcontractor's work.

1.6.3 Job Hazard Analysis

Based on the construction schedule, the Contractor shall submit a job hazard analysis of each major phase of work prior to entering that phase of activity. The analysis shall include major or high risk hazards, as well as commonly recurring deficiencies that might possibly be encountered for that operation, and shall identify proposed methods and techniques of accomplishing each phase in a safe manner. The Prime Contractor's superintendent shall take active participation in the Job Hazard Analysis, including the subcontractors' work. Prior to start of actual work a meeting shall be held with Prime Contractor, Government, and affected subcontractor to review the Job Hazard Analysis. In addition, job site meetings shall be held to indoctrinate foreman and workers on details of this analysis.

1.6.3.1 Explosive Ordnance

Explosive Ordnance: The project site has been cleared of explosive ordnance by the Army E.O.D. In the event that the Contractor encounters any explosive devices or objects of a suspicious nature, he shall immediately clear the site of all employees and notify the Contracting Officer's Representative. All employees are to be trained in familiarizing themselves with explosive ordnance and safety procedures. This training will be conducted by the Government. The job hazard analysis shall address this in specific detail.

1.6.4 Violations

If recurring violations and/or gross violation indicate that the safety performance is unsatisfactory, corrective action shall be taken as directed, and at the discretion of the Contracting Officer the retention or some part thereof will be withheld from the progress payment until corrective action has been completed.

1.6.5 Elevated Work Areas

Workers in elevated work areas in excess of 6 feet above an adjoining surface require special safety attention. In addition to the provisions of EM 385-1-1, the following safety measures are required to be submitted to the Contracting Officer's Representative. Prior to commencement of work in elevated work areas, the Contractor shall submit drawings depicting all provisions of his positive protection system including, but not limited to, all details of guard rails.

1.6.5.1 Protection

Positive protection for workmen engaged in the installation of structural steel and steel joists shall be provided by safety nets, tie-off's, hydraulic man lifts, scaffolds, or other required means. Decking crews must be tied-off or work over nets or platforms not over 6 feet below the work area. Walking on beams and/or girders and the climbing of columns is prohibited without positive protection.

1.6.5.2 Guard Rails

Perimeter guard rails shall be installed at floor, roof, or wall openings more than 6 feet above an adjoining surface and on roof perimeters. Rails shall be designed to protect all phases of elevated work including, but not limited to, roofing operations and installation of gutters and flashing. Rails around roofs may not be removed until all work on the roof is complete and all traffic on or across the roof ceases. Rails shall be designed by a licensed engineer to provide adequate stability under any anticipated impact loading. As a minimum, the rails shall consist of a top rail at a height of 42 inches, a mid rail and a toe board. Use of tie-offs, hydraulic man lifts, scaffolds, or other means of roof edge protection methods may be utilized on small structures such as family housing, prefabricated metal buildings, etc.

1.6.6 Fire Prevention

Twenty-four hours notice shall be given to the Contracting Officer for coordination with the Facility Fire Department prior to conducting any fire hazardous operation. Cutting or welding will be permitted only in areas that are or have been made fire safeWhere possible, all combustibles shall be located at least 35 feet horizontally from the work site. Where such location is impracticable, combustibles shall be protected with fire blankets and/or protective welding screens to prevent slag from running out of the work area. Edges of covers at the floor shall be tight to prevent sparks from going under them. This precaution is also important at overlaps where several covers are used to protect a large pile. The Contractor shall not allow any welding/cutting or open flame operations in facilities that are protected by a wet pipe fire sprinkler or an automatic detection system, if the system is out of service. First priority of work will be to return the suppression/detection system to operational condition. Return the fire detection and/or suppression system back to an operational status (if

possible) during periods that the facility is unoccupied, and at the end of the work day. The Contractor shall post a fire guard for a 24 hour period (or certify to the Fire Department that the facility is safe) after welding, cutting, and open flame operations in a facility when: (a) fire detection and suppression system can not be returned to service; (b) fire detection or suppression systems do not exist. Other fire prevention precautions shall be in accordance with the latest National Fire Codes.

1.6.7 Recordkeeping/Reporting Requirements

On all contract operations, the Prime Contractor shall be responsible for recording and reporting all accident exposure and experience incident work. (This includes exposure and experience of the prime contractor and his/her sub-contractor(s)). As a minimum these records shall include exposure work-hours and a log of occupational injuries and illnesses. (OSHA Form 200 or state equivalent as prescribed by 29 CFR 1904.5) Reference EM 385-1-1, 01.D.04.

1.6.8 Accident Reporting

In addition to the requirements for reporting accidents in accordance with EM 385-1-1, Section 1, the Prime Contractor will submit at the 50% point and 100% of project completion, a written summary of worker's compensation claims filed by workers on the project. The report will include all subcontractors. The main report covering the Prime Contractor claims will be certified as "correct and true" by the Contractor's compensation insurance carrier. The same certification will be required for subcontractor reports.

1.7 PLANNED UTILITY OUTAGES AND STREET CLOSURES

All utility outages and street closures shall be of as short a duration as possible and shall be scheduled as far in advance as possible with the Directorate of Public Works (DPW), Building 385, in no case less than 14 days before the outage or closure. The Contractor shall obtain in writing from the DPW a statement or schedule giving the permissible times of outages or closures for particular installations and the maximum time allowed for each. The Contractor shall strictly observe such schedules and will be held responsible for any violations. A copy of the schedule, provided by the DPW, will be provided to the Resident Engineer, prior to the outage.

1.8 EXCAVATION PERMITS

All excavation permits will be issued directly to the Contractor from the Directorate of Public Works (DPW). The appropriate form, for this request, may be obtained from the DPW of the Resident Office. Processing time required by the DPW is 14 calendar days. Questions concerning the excavation permit should be directed to the Directorate of Public Works.

1.9 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

(A) This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the CONTRACT CLAUSE, Section 00700, entitled "DEFAULT (FIXED-PRICE CONSTRUCTION)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

(1) The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

(2) The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

(B) The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY WORK DAYS BASED ON (5) DAY WORK WEEK

ELEMENT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Precipitation over 0.10"	2	1	1	0	0	0	0	0	1	0	1	1
Temperature below 32 degrees F	18	9	4	0	0	0	0	0	0	0	6	20
Surface Wind over 17 Knots (20MPH)	2	3	5	5	4	2	1	1	1	2	2	3

(C) Upon acknowledgement of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day.

(ER 415-1-15, 31 OCT 89)

1.10 SPECIAL CONSTRUCTION PROCEDURES

(A) Temporary Fence:

The Contractor shall erect and maintain a temporary site fence. The fence shall be at least a 6'-0" high chain link fence installed on metal posts. A vision inhibitor consisting of slats or other approved means, shall be installed. The fence shall be capable of withstanding wind loads of 60 m.p.h. without damage. All materials and installation are subject to approval of the Contracting Officer's Representative. The fence shall encompass the entire project site. The fence location and design shall be submitted for approval. The submittal shall provide detailed drawings and computations signed by a registered engineer. The layout will include the proposed location of access gates. Gates are to be locked at all times when the Contractor is not on site. For purposes of safety, the Contractor shall provide tagged keys to the Fort Irwin Resident Engineer's Office and the Fort Irwin Fire Department. The Contractor shall clean daily the fence perimeter, both within the fence and outside of the fence to prevent any accumulation of trash and debris adjacent to the fence. The fence will be removed upon a written notice by the Contracting Officer's Representative.

(B) Digging permits require 10 working days notification.

(C) Work hours are 7:30 a.m. to 4:00 p.m., Monday through Friday.

(D) The contractor shall employ a full time on-site Safety Officer for the duration of the project.

E) All reclaimed water shall be used for construction purposes if available.

(F) The Contract drawings and specifications or CD's should be provided to the field office within the ten (10) working day period after the NTP.

1.11 MANDATORY WORK STOPPAGES

(A) A mandatory work stoppage occurs whenever the Contractor is restricted from working a full workday and is unable to reallocate work forces to other locations. All costs associated with five mandatory work stoppages must be included in the bid price. No additional compensation or extension to the Contract performance period will be given as a result of five mandatory work stoppages.

(1) In the event that the Contractor's work force is required to evacuate any part of the working area during working hours established by the Contractor for this contract, the Government will then make an adjustment under the clause entitled, FAR 52.212-12 SUSPENSION OF WORK, see Section 00700. The Government's liability will be considered to be limited to reimbursement for loss of time of Contractor's employees and equipment which otherwise would have been employed on the job. The completion time for any part of the work will not be extended if the total number of working hours of work stoppage does not exceed 0.8 times the number of calendar days in the period between the date of notice to proceed and the specified completion date. In the event the Contractor is required to evacuate the area in excess of the time specified above, the completion times will be adjusted.

(B) The Contractor may be required, without advance notice, to move work to a different location. The Contractor shall be prepared to increase or decrease his work forces with appropriate trades to perform work in the relocated work areas at no additional cost to the Government.

(C) The Contractor shall notify the Contracting Officer when a mandatory work stoppage occurs for recording purposes. Otherwise, the work stoppage will not be credited to the Contractor.

1.12 DISPOSAL OF REMOVED MATERIALS

(A) The Government inspector will examine all materials removed from the project not indicated for reuse, and will tag or otherwise designate those materials which are serviceable or salvable.

(B) Serviceable or salvageable items, except for locks, latches, and cylinders, shall be turned in, by appointment, to the base Defense Reutilization and Marketing Office (DRMO) or Base Supply by the Contractor. All locks, latches, and cylinders shall be turned in to the Base Lockshop. The Contractor shall schedule DRMO appointments far enough in advance to allow efficient processing of turn-ins. Scrap metal shall be segregated into ferrous and nonferrous metals, and shall be cut, dismantled, palletized, or prepared as required by the DRMO office for acceptance. Dismantling of equipment or material into separate components may be required. The Contractor shall protect materials from damage or theft during the interval between removal and disposal. Any serviceable or salvageable items not accepted by DRMO or Base Supply, for whatever reason, will become the property of the Contractor and will be properly handled, transported, and be disposed of off-base by the Contractor in conformance with all federal, state, and local regulations. See Section 014310 for disposal of hazardous materials.

(C) Contaminated soil:

This project is located in a traditional non-hazardous location, the surface is unused desert environment. In the event of an encounter with contamination during construction, the following specific guidance will apply:

(1) If visual evidence and/or detectable odor is encountered, construction work shall stop immediately and the Contractor shall notify the Post Environmental Branch, extension 3740. The Directorate of Public Works (DPW) Environmental Branch will immediately perform a preliminary site investigation to include samples and analysis. Then, based on findings, will initiate clean up procedures. After clean up procedures are completed, the area will be resampled and reanalyzed to certify that the area is clean of contamination and if clean, work would be allowed to continue. The DPW Environmental Branch will certify in writing that the area is clean and construction work may continue.

1.13 CONTRACTOR SAFETY PERSONNEL REQUIREMENTS (1985 JAN HQ USACE)

(A) On-site, safety coverage by contractors shall be required for the life of the contract.

(B) The Prime Contractor's Superintendent

The Prime Contractor shall employ a full-time Safety Officer that shall take an active role in enforcing the safety requirements by participation in safety conferences, hazard analysis, tool box meetings, walk-through inspections, correction of violations, etc., and including that of the subcontractor's work.

1.14 MONTHLY SAFETY INSPECTION

A monthly on-site inspection will be made by the insurance carriers of the prime and subcontractors. The Contractor's safety program will be reviewed and a meeting will be held with the Contracting Officer's Representative to discuss the job-site safety. A written report will be made by the Contractor stating the results of the inspection and the action taken.

1.15 WARRANTY PROBLEM PROCEDURE

Upon receipt of the written notice from the Contracting Officer as stated in paragraph WARRANTY OF CONSTRUCTION, subparagraph 5, the Contractor shall report to Building Number 384, BSI Work Order Branch, to pick up a copy of the work order describing the warranty problem. After the warranty item has been corrected the Contractor shall return the completed work order to Building Number 384 and indicate the corrective action taken.

1.16 AGGREGATE SOURCES

(A) Concrete aggregates may be produced from the approved sources listed below:

(1) Sources of fine aggregate. (List the sources in an appropriate manner.)

(2) Sources of coarse aggregate. (List the sources in an appropriate manner.)

(B) Concrete aggregates may be furnished from any of the above listed sources or at the option of the Contractor may be furnished from any other source designated by the Contractor and approved by the Contracting Officer, subject to the conditions hereinafter stated.

(C) After the award of the contract, the Contractor shall designate in writing, only one source or one combination of sources from which he proposes to furnish aggregates. If the Contractor proposes to furnish aggregates from a source or from sources not listed above, he may designate only a single source or a single combination of sources for aggregates. Samples for acceptance testing shall be provided as required by Section: of the Technical Specifications. If a source for coarse or fine aggregate so designated by the Contractor is not approved for use by the Contracting Officer, the Contractor may not submit for approval other sources but shall furnish the coarse or fine aggregate, as the case may be, from a listed source listed above at no additional cost to the Government.

(D) Listing of a concrete aggregate source is not to be construed as approval of all material from that source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels, when such materials are unsuitable for concrete aggregate as determined by the Contracting Officer. Materials produced from a listed source shall meet all the requirements of the Technical Specifications of these specifications.

1.17 COLOR SCHEME FOR CONTRACTOR FACILITIES

(A) All Contractor storage and operational facilities including temporary structures, signs and fencing, that remain at the site shall be compatible with the color scheme used on the project signs as directed by the Contracting Officer.

1.18 AGGREGATE SOURCES

(A) Concrete aggregates can potentially be produced from the available on post sources listed below:

(1) Sources of fine aggregate.

a. Fine Aggregate Borrow Site No. 3 on Ft. Irwin*

(2) Sources of coarse aggregate.

a. Coarse Aggregate Borrow Site No. 1 on Ft Irwin*

*For locations and log descriptions of the "on-post" borrow sites refer to the contract drawings (sheets B6.007, B3.008-B3.010). At this time the Ft. Irwin DPW does not permit Fine Aggregate Borrow Site No. 2 as an aggregate source. In order to meet the specified requirements indicated in the section specifications, the aggregate sources shall require processing, crushing and washing before mixture proportioning can be done. It should be understood, that not all the material found in the aggregate source is adequate for use as aggregates. There will be some materials located in the borrow source that will not provide the desired results and will need to be wasted.

(B) Concrete aggregates may be furnished from any of the above listed sources or at the option of the Contractor may be furnished from any other source approved by the Contracting Officer, subject to the conditions hereinafter stated. The Contractor shall provide tests that prove both the on and the off-post aggregate sources meet the requirements specified in Section: 02753.

(C) After the award of the contract, the Contractor shall designate in writing, only one source or one combination of sources from which he proposes to furnish aggregates. If the Contractor proposes to furnish aggregates from a source or from sources not listed above, he shall designate only a single source or a single combination of sources for aggregates. Samples for acceptance testing shall be provided as required by Section: 02753 of the Technical Specifications. If a source for coarse or fine aggregate not listed above is not approved for use by the Contracting Officer, the Contractor shall not submit for approval other sources but shall furnish the coarse or fine aggregate, as the case may be, from a source listed above at no additional cost to the Government.

(D) Listing of a concrete aggregate source shall not to be construed as approval of all material from that source. The right is reserved to

reject materials from certain localized areas, zones, strata, or channels, when such materials are unsuitable for concrete aggregate as determined by the Contracting Officer. Materials produced from a listed source shall meet all the requirements of Section: 02753 of the Technical Specifications of these specifications.

(E) Explorations of On-Post Sources: The on-post aggregate sites have been explored by the Government to determine the character and extent of materials available. The locations of the exploration trenches and their corresponding logs are shown on the contract drawings. These data are the result of limited explorations and tests conducted by and for the Government, and are accurate to the extent of the scope of the investigations conducted. The Government shall not be responsible for any deduction, interpretation or conclusion drawn there from by the Contractor.

(F) Operations for On-Post Sources:

(1) Limits of Work Area: The limits of the area within which operations may be carried must be coordinated with the on post DPW. The depth to which the Contractor may operate shall be subject to approval, but shall be limited only by the extent of the existence of satisfactory material.

(2) Disposal of Waste Materials: All overburden removed, and all other waste material including materials designated unsuitable for use in the production of concrete aggregate shall be disposed of in approved disposal areas. All disposal areas shall be left in a neat and sightly condition, graded and sloped to drain properly to the satisfaction of the Contracting Officer. No separate payment will be made for the disposal of waste material but the cost thereof shall be included in the respective bid prices for the various parts of the concrete work in which the aggregates are used.

(3) Plan of Operations: Prior to beginning operations in the deposit, the Contractor shall submit a plan of operation in sufficient detail to indicate the following:

- (i) The proposed extent of the operation including depth.
- (ii) The method and schedule of overburden stripping operations.
- (iii) The proposed location of waste disposal areas.

The plan of operations in the deposit shall be subject to approval, but approval of the plan will not in any way relieve the Contractor of the responsibility to operate in the deposit in a safe and systematic manner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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SECTION 01780A

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

As-Built Drawings; FIO

Drawings showing final as-built conditions of the project. [The final CADD as-built drawings shall consist of one set of electronic CADD drawing files in the specified format, one set of mylar drawings, 2 sets of blue-line prints of the mylars, and one set of the approved working as-built drawings.] [The manually prepared drawings shall consist of 1 set of completed final as-built original transparency drawings, 2 sets of blue-line prints of the transparencies, and the approved marked working as-built prints.]

SD-03 Product Data

As-Built Record of Equipment and Materials; FO

Two copies of the record listing the as-built materials and equipment incorporated into the construction of the project.

Warranty Management Plan; FIO

One set of the warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. The Contractor shall furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

Warranty Tags; FIO

Two record copies of the warranty tags showing the layout and design.

Final Cleaning; FIO

Two copies of the listing of completed final clean-up items.

1.2 PROJECT RECORD DOCUMENTS

1.2.1 As-Built Drawings

This paragraph covers as-built drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working as-built drawings" and "final as-built drawings" refer to contract drawings which are revised to be used for final as-built drawings.

1.2.1.1 Government Furnished Materials

One set of electronic CADD files in the specified software and format revised to reflect all bid amendments will be provided by the Government at the preconstruction conference for projects requiring CADD file as-built drawings.

1.2.1.2 Working As-Built and Final As-Built Drawings

The Contractor shall revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. These working as-built marked drawings shall be kept current on a weekly basis and at least one set shall be available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes.

Final as-built drawings shall be prepared after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final as-built drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final as-built drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the as-built drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. The working and final as-built drawings shall show, but shall not be limited to, the following information:

- a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

- b. The location and dimensions of any changes within the building structure.

- c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

- d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material,

dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

g. Where contract drawings or specifications present options, only the option selected for construction shall be shown on the final as-built prints.

h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, the Contractor shall furnish a contour map of the final borrow pit/spoil area elevations.

i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

j. Modifications (change order price shall include the Contractor's cost to change working and final as-built drawings to reflect modifications) and compliance with the following procedures.

- (1) Directions in the modification for posting descriptive changes shall be followed.
- (2) A Modification Circle shall be placed at the location of each deletion.
- (3) For new details or sections which are added to a drawing, a Modification Circle shall be placed by the detail or section title.
- (4) For minor changes, a Modification Circle shall be placed by the area changed on the drawing (each location).
- (5) For major changes to a drawing, a Modification Circle shall be placed by the title of the affected plan, section, or detail at each location.
- (6) For changes to schedules or drawings, a Modification Circle shall be placed either by the schedule heading or by the change in the schedule.
- (7) The Modification Circle size shall be 1/2 inch diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas.

1.2.1.3 Drawing Preparation

The as-built drawings shall be modified as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints shall be neat, legible and accurate. These drawings are part of the permanent records of this project and shall be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at no expense to the Government.

1.2.1.4 Computer Aided Design and Drafting (CADD) Drawings

Only personnel proficient in the preparation of CADD drawings shall be employed to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings shall be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols shall be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, they shall be prepared using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final as-built drawings shall be identical to that used on the contract drawings. Additions and corrections to the contract drawings shall be accomplished using CADD files. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). The Contractor shall be responsible for providing all program files and hardware necessary to prepare final as-built drawings. The Contracting Officer will review final as-built drawings for accuracy and the Contractor shall make required corrections, changes, additions, and deletions.

a. CADD colors shall be the "base" colors of red, green, and blue. Color code for changes shall be as follows:

- (1) Deletions (red) - Deleted graphic items (lines) shall be colored red with red lettering in notes and leaders.
- (2) Additions (Green) - Added items shall be drawn in green with green lettering in notes and leaders.
- (3) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes shall be in blue.

b. The Contract Drawing files shall be renamed in a manner related to the contract number (i.e., 98-C-10.DGN) as instructed in the Pre-Construction conference. Marked-up changes shall be made only to those renamed files. All changes shall be made on the layer/level as the original item. There shall be no deletions of existing lines; existing lines shall be over struck in red. Additions shall be in green with line weights the same as the drawing. Special notes shall be in blue on layer #63.

c. When final revisions have been completed, the cover sheet drawing shall show the wording "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 3/16 inch high. All other contract drawings shall be marked either "AS-Built" drawing denoting no revisions on the sheet or "Revised As-Built" denoting one or more revisions. Original contract drawings shall be dated in the revision block.

d. Within 20 days for contracts \$5 million and above after Government approval of all of the working as-built drawings for a phase of work, the Contractor shall prepare the final CADD as-built drawings for that phase of work and submit two sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days for contracts \$5 million and above the Contractor shall revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days for contracts \$5 million and above of substantial completion of all phases of work, the Contractor shall submit the final as-built drawing package for

the entire project. The submittal shall consist of one set of electronic files on compact disc, read-only memory (CD-ROM), one set of mylars, two sets of blue-line prints and one set of the approved working as-built drawings. They shall be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final as-built drawing files and marked prints as specified shall be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

1.2.1.5 Manually Prepared Drawings

Only personnel proficient in the preparation of manually prepared drawings shall be employed to modify the original contract drawing or prepare additional new drawings. Additions and corrections to the contract drawings shall be neat, clean and legible, shall be done to the same level of detail, and shall match the adjacent existing line work, and lettering being annotated in type, density, size and style. Drafting work shall be done using the same medium (pencil, plastic lead or ink) that was employed on the original contract drawings and with graphite lead on paper base material. The Contracting Officer will review as-built drawings for accuracy and conformance to the above specified drafting standards. Corrections, changes, additions, and deletions required shall meet these standards. The title block to be used for any new as-built drawings shall be similar to that used on the original drawings.

a. When final revisions have been completed, each drawing shall be lettered or stamped with the words "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 3/16 inch high. Original contract drawings shall be marked either "As-Built" drawings denoting no revisions on the sheet or "Revised As-Built" denoting one or more revisions. All original contract drawings shall be dated in the revision block.

b. Within 20 days for contracts \$5 million and above after Government approval of all of the working as-built drawings for a phase of work, the Contractor shall prepare the final as-built drawings for that phase of work and submit two sets of blue-line prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days for contracts \$5 million and above the Contractor shall revise the drawings accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days for contracts \$5 million and above of substantial completion of all phases of work, the Contractor shall submit the final as-built drawing package for the entire project. The submittal shall consist of the completed final as-built drawings, two blue-line prints of these drawings and the return of the approved marked as-built prints. The drawings shall be complete in all details. Paper prints and reproducible drawings will become the property of the Government upon final approval. Failure to submit final as-built drawings and marked prints, as required herein, will be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

1.2.1.6 Payment

No separate payment will be made for as-built drawings required under this contract, and all costs accrued in connection with such drawings shall be considered a subsidiary obligation of the Contractor.

1.2.2 As-Built Record of Equipment and Materials

The Contractor shall furnish one copy of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Two sets of final record of equipment and materials shall be submitted 10 days after final inspection. The designations shall be keyed to the related area depicted on the contract drawings. The record shall list the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA

Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used
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1.2.3 Final Approved Shop Drawings

The Contractor shall furnish final approved project shop drawings 30 days after transfer of the completed facility.

1.2.4 Construction Contract Specifications

The Contractor shall furnish final as-built construction contract specifications, including modifications thereto, 30 days after transfer of the completed facility.

1.2.5 Real Property Equipment

The Contractor shall furnish a list of installed equipment furnished under this contract. The list shall include all information usually listed on manufacturer's name plate. The "EQUIPMENT-IN-PLACE LIST" shall include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. A draft list shall be furnished at time of transfer. The final list shall be furnished 30 days after transfer of the completed facility.

1.3 WARRANTY MANAGEMENT

1.3.1 Warranty Management Plan

The Contractor shall develop a warranty management plan which shall contain information relevant to the clause Warranty of Construction in Specifications. At least 30 days before the planned pre-warranty conference, the Contractor shall submit the warranty management plan for Government approval. The warranty management plan shall include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future

maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase shall be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Approved information shall be assembled in a binder and shall be turned over to the Government upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and shall continue for the full product warranty period. A joint 4 month and 9 month warranty inspection shall be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Information contained in the warranty management plan shall include, but shall not be limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.

c. A list for each warranted equipment, item, feature of construction or system indicating:

1. Name of item.
2. Model and serial numbers.
3. Location where installed.
4. Name and phone numbers of manufacturers or suppliers.
5. Names, addresses and telephone numbers of sources of spare parts.
6. Warranties and terms of warranty. This shall include one-year overall warranty of construction. Items which have extended warranties shall be indicated with separate warranty expiration dates.
7. Cross-reference to warranty certificates as applicable.
8. Starting point and duration of warranty period.
9. Summary of maintenance procedures required to continue the warranty in force.
10. Cross-reference to specific pertinent Operation and Maintenance manuals.
11. Organization, names and phone numbers of persons to call for warranty service.
12. Typical response time and repair time expected for various warranted equipment.

d. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

e. Procedure and status of tagging of all equipment covered by extended warranties.

f. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.3.2 Performance Bond

The Contractor's Performance Bond shall remain effective throughout the construction period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.3.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor shall furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, shall be continuously available, and shall be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.3.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. The Contractor shall submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframes specified, the Government will perform the work and backcharge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

1.3.5 Warranty Tags

At the time of installation, each warranted item shall be tagged with a durable, oil and water resistant tag approved by the Contracting Officer. Each tag shall be attached with a copper wire and shall be sprayed with a silicone waterproof coating. The date of acceptance and the QC signature shall remain blank until project is accepted for beneficial occupancy. The tag shall show the following information.

- a. Type of product/material_____.
- b. Model number_____.
- c. Serial number_____.
- d. Contract number_____.
- e. Warranty period_____from_____to_____.
- f. Inspector's signature_____.
- g. Construction Contractor_____.
- Address_____.
- Telephone number_____.
- h. Warranty contact_____.
- Address_____.
- Telephone number_____.
- i. Warranty response time priority code_____.

j. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

1.4 MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

Prior to final inspection and transfer of the completed facility; all reports, statements, certificates, and completed checklists for testing, adjusting, balancing, and commissioning of mechanical systems shall be submitted to and approved by the Contracting Officer as specified in applicable technical specification sections.

1.5 OPERATION AND MAINTENANCE MANUALS

Operation manuals and maintenance manuals shall be submitted as specified. Operation manuals and maintenance manuals provided in a common volume shall be clearly differentiated and shall be separately indexed.

1.6 FINAL CLEANING

The premises shall be left broom clean. Stains, foreign substances, and temporary labels shall be removed from surfaces. Carpet and soft surfaces shall be vacuumed. Equipment and fixtures shall be cleaned to a sanitary condition. Filters of operating equipment shall be cleaned. Debris shall be removed from roofs, drainage systems, gutters, and downspouts. Paved areas shall be swept and landscaped areas shall be raked clean. The site shall have waste, surplus materials, and rubbish removed. The project area shall have temporary structures, barricades, project signs, and construction facilities removed. A list of completed clean-up items shall be submitted on the day of final inspection.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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SECTION 02220

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SECTION 02220

DEMOLITION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6 (1990) Safety Requirements for Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 GENERAL REQUIREMENTS

Do not begin demolition until authorization is received from the Contracting Officer. Remove rubbish and debris from the project site; do not allow accumulations on pavements. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Work Plan; RO

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, including procedures and methods to provide necessary supports, lateral bracing and shoring when required, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The contractor shall coordinate all demolition with the traffic

handling plan requirements indicated in the plans. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations in accordance with EM 385-1-1.

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," safety requirements shall conform with ANSI A10.6.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris on pavements and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to vehicular traffic.

1.6 PROTECTION

1.6.1 Traffic Control Signs

Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. All traffic control shall be in compliance with Section 12 of CALTRANS Standard Specifications. Notify the Contracting Officer prior to beginning such work.

1.6.2 Existing Work

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work. Do not overload pavements to remain. Repairs, reinforcement, or structural replacement must have Contracting Officer approval.

1.6.3 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas so as to ensure effectiveness and to prevent displacement.

1.6.4 Landscaping

Landscaping within the project site which might be damaged during demolition, and which are indicated to be left in place, shall be protected by a 6 foot high fence. The fence shall be securely erected a minimum of 5 feet from the landscaping. Any landscaping designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the Contracting Officer.

1.6.5 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Contracting Officer. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.6.6 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.7 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the Contracting Officer.

1.9 Required Data

Demolition plan shall include procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, and a detailed description of methods and equipment to be used for each operation and of the sequence of operations.

1.10 USE OF EXPLOSIVES

Use of explosives will not be permitted.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

3.1.1 Structures

Existing structures indicated shall be completely removed. Sidewalks, curbs, gutters and street light bases shall be removed as indicated.

3.1.2 Utilities and Related Equipment

Remove existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area. Remove meters and related equipment and deliver to a location on the station in accordance with instructions of the Contracting Officer. If utility lines are encountered that are not shown on drawings, contact the Contracting Officer for further instructions.

3.1.3 Paving and Slabs

Remove and sawcut concrete and asphaltic concrete paving and slabs including aggregate base as indicated on the Contract Drawings and construction details. Provide neat straight sawcuts at limits of pavement removal as indicated.

3.2 DISPOSITION OF MATERIAL

3.2.1 Title to Materials

Except where specified in other sections, all materials and equipment removed, and not reused, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

3.2.2 Salvaged Materials and Equipment

Remove materials and equipment that are indicated to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site, as directed.

3.2.3 Unsalvageable Material

Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of in the Fort Irwin disposal area. Combustible material shall be disposed of in the Fort Irwin disposal area.

3.3 CLEANUP

Debris and rubbish shall be removed from excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

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2.1 [Enter Appropriate Subpart Title Here]

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3.4 DISPOSAL OF MATERIALS

3.4.1 [Enter Appropriate Subpart Title Here]

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SECTION 02231

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Materials Other Than Salable Timber

Written permission to dispose of such products on private property shall be filed with the Contracting Officer.

1.2 [Enter Appropriate Subpart Title Here]

PART 2 PRODUCTS (Not Applicable)

2.1 [Enter Appropriate Subpart Title Here]

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the Contractor shall notify the Contracting Officer in ample time to minimize interruption of the service.

3.2 CLEARING

Roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such vegetation as may be indicated or directed to be left standing. Vegetation designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work.

3.3 GRUBBING

Grubbing shall consist of the removal and disposal of stumps and roots, and matted roots from the designated grubbing areas. Material to be grubbed and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.4 DISPOSAL OF MATERIALS3.4.1 [Enter Appropriate Subpart Title Here]

Vegetation, debris, roots, brush, and other refuse from the clearing and grubbing operations shall be disposed of outside the limits of Government-controlled land at the Contractor's responsibility. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

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SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 SCOPE OF WORK

This guide specification includes all excavating, grading, and associated operations that may be required under a construction contract, except earthwork for buildings and utilities. Earthwork for building pads is specified under section 02315 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS. All utility earthwork is specified under section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1990) Materials Finer Than 75-um (No.200) Sieve in Mineral Aggregates by Washing
ASTM C 136	(1993) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2216	(1992) Laboratory Determination of Water(Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
ASTM D 2217	(1985) Wet Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Constants
ASTM D 2487	(1992;R 1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988) Water Content of Soil and Rock in

Place by Nuclear Methods (Shallow Depth)

ASTM D 3740	(1992) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D 4318	(1984) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 548	(1991) Preparation of Criteria for Use in the Evaluation of Testing Laboratories and Inspection Bodies

CORPS OF ENGINEERS, SACRAMENTO DISTRICT (COE)

CESPK PAM 415-1-2	(1989) Construction Control Manual
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1.3 DEFINITIONS

1.3.1 Satisfactory Material

Materials from on-site excavations that classify according to ASTM D 2487 as GW, GP, GC, GM, SW, SP, SC, SM, and combinations of these such as SP-SM, are satisfactory for fill and backfill for the project. In addition, satisfactory material shall have a maximum particle size of 2 inches and be free of organic material and debris.

1.3.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Materials classified in accordance with ASTM D 2487 as CH, MH, CL, ML, Apt, OH, and OL are unsatisfactory.

1.3.3 Degree of Compaction

Degree of compaction is the ratio of the field dry density to the maximum dry density determined in the laboratory, expressed as a percentage. The laboratory maximum dry density shall be obtained according to ASTM D 1557, Procedure C.

1.3.4 Soil Classification Testing

Tests shall be performed by the Contractor for the determination of satisfactory material in accordance with CESPK PAM 415-1-2, the Construction Control Manual. Certified test reports shall be furnished to the Contracting Officer for approval prior to use of the material. Materials shall be classified in accordance with ASTM D 2487. Gradations shall be determined in accordance with ASTM C 117 and ASTM C 136. Atterberg limits shall be determined in conformance with ASTM D 4318, method A on samples prepared in accordance with ASTM D 2217.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government: "RE" for Resident

Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Field Testing Control

Qualifications of the commercial testing laboratory who will be performing all testing in accordance with paragraph FIELD TESTING CONTROL.

SD-01 Pre Construction Submittals

Borrow Material; G. Satisfactory Material; G.

Certified test reports and analysis certifying that the borrow material and the satisfactory material proposed for use at the project site conform to the specified requirements.

SD-09 Test Reports.

Field Testing Control

All tests conducted in accordance with paragraph FIELD TESTING CONTROL.

1.5 SUBSURFACE DATA

Subsurface soil exploration logs are shown on the drawings. The data represent the best subsurface information available; however, variations may exist across the building site.

PART 2 PRODUCTS

2.1 BORROW MATERIAL

Borrow material shall be satisfactory and selected to meet requirements and conditions of the particular fill for which it is to be used. Necessary clearing, grubbing, disposal of debris and satisfactory drainage of borrow pits shall be performed by the Contractor as incidental operations to the borrow excavation.

2.1.1 Selection

Borrow material may be obtained from sources outside of the installation or from sources within the limits of Government-controlled land, subject to approval by the Contracting Officer. Material from Government borrow pits may be obtained without payment of royalties. The source of imported material shall be the Contractor's responsibility. Unless otherwise provided in the contract, the Contractor shall obtain from the owners of the borrow pit the right to procure material, shall pay all royalties and other expenses involved, and shall develop the source, including rights-of-way for hauling.

2.1.2 Borrow Material

Borrow material shall be free of organics and debris and shall conform to the following gradation and Atterberg Limits:

Sieve Size	Percent Passing by Weight
2 inches	100
No. 4	50-90
No. 200	5-35

Liquid Limit of less than 35.

Plasticity Index of less than 12.

PART 3 EXECUTION

3.1 EXCAVATION

Excavation of every description, regardless of material encountered, within the grading limits of the project shall be performed to the lines and grades indicated. Satisfactory material shall be transported to and placed in fill areas within the limits of the work. Unsatisfactory material which does not contain stripping and construction debris and surplus satisfactory material shall be disposed at designated waste areas. All construction debris and stripping shall be removed from Government-controlled land, at the Contractor's expense, prior to the completion of construction. In the event that it is necessary to remove unsatisfactory material to a depth greater than specified, the Contracting Officer shall be notified. No additional compensation shall be forthcoming for the excavation and replacement of materials rendered unsatisfactory by Contractor managed operations. A change in the Contract price shall be considered for incidents where unsatisfactory materials are encountered at depths and/or locations that are substantially different from those shown on the Contract Exploration Logs. Excavations carried below the depths indicated, without specific directions, shall be refilled to the proper grade with properly compacted satisfactory material at the Contractor's expense. Excavation and filling shall be performed in a manner and sequence that will provide drainage at all times. Excavations shall be kept free from water while construction therein is in progress. Material required for fill in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated on the drawings or imported.

3.2 DITCHES, GUTTERS, AND CHANNEL CHANGES

Ditches, gutters, and channel changes shall be cut accurately to the cross sections and grades indicated. All roots, stumps, rock, and foreign matter in the sides and bottom of ditches, gutters, and channel changes shall be trimmed and dressed or removed to conform to the slope, grade, and shape of the section indicated. Care shall be taken not to excavate ditches and gutters below the grades indicated. Excessive ditch and gutter excavation shall be backfilled to grade either with satisfactory, thoroughly compacted material or with suitable stone or cobble to form an adequate gutter paving as directed. All ditches and gutters excavated under this section shall be maintained until final acceptance of the work. Satisfactory material excavated from ditches and channel changes may be placed in fill areas. Unsatisfactory and excess excavated material shall be disposed of in accordance with directions in paragraph EXCAVATION. No excavated material shall be deposited closer to the edges of the ditches than indicated and in no case less than 3 feet.

3.3 BACKFILL ADJACENT TO STRUCTURES

Backfill adjacent to structures shall be placed and compacted uniformly in

such manner as to prevent wedging action or eccentric loading upon or against the structures. Slopes bounding or within areas to be backfilled shall be stepped or serrated to prevent sliding of the fill. During backfilling operations and in the formation of embankments, equipment that will overload the structure in passing over and compacting these fills shall not be used. Backfill for storm drains and subdrains, including the bedding and backfill for structures other than culverts and drains, shall conform to the additional requirements in other applicable sections.

3.4 PREPARATION OF GROUND SURFACE FOR FILL

All vegetation, such as roots, brush, grass, and all decayed vegetable matter, rubbish, and other unsatisfactory material within the area upon which fill is to be placed, shall be stripped and removed. Following stripping, the ground surface on which fill will be placed shall be plowed and disked to a minimum depth of 6 inches; clay balls and cemented clods shall be pulverized; the soil moistened or aerated, as necessary, and thoroughly mixed. The scarified layer shall then be compacted to at least 95 percent degree of compaction. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be plowed, stepped, or broken up, as directed, in such manner that the fill material will bond with the existing surface.

3.5 FILLS AND EMBANKMENTS

Fills and embankments shall be constructed at the locations and to lines and grades indicated. The completed fill shall conform to the shape of the typical sections indicated. The material shall be placed in successive horizontal layers of 8 inches in loose depth for the full width of the cross section and shall be compacted as specified. Each layer shall be compacted and tested before the overlaying lift is placed. Moisture content of the fill or backfill material shall be adjusted by wetting or aerating, as required, to within plus or minus 2 percent of optimum moisture content as determined from laboratory tests specified in paragraph DEFINITIONS.

3.6 COMPACTION

The subgrade in hardstand areas shall be compacted to at least 95%. The moisture content shall be within plus or minus 2 percent of the optimum moisture content.

3.7 FINISHED EXCAVATION, FILLS, AND EMBANKMENTS

All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade-grader operations, except as otherwise specified. Ditches and gutters shall be finished to permit adequate drainage. For subgrade areas to be paved, the following shall be accomplished as required: (a) low areas resulting from removal of unsatisfactory material, including cobbles and boulders, shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and shall be compacted as specified. The surface of areas on which pavement is to be placed shall vary not more than 0.05 foot from the established grade and approved cross section. Other surfaces shall be finished not more than 0.10 foot above or below the established grade or approved cross section.

3.8 FIELD TESTING CONTROL

Contractor quality control testing shall be performed in accordance with the Construction Control Manual, CESPCK PAM 415-1-2. Testing shall be the responsibility of the Contractor and shall be performed by an independent commercial testing laboratory in accordance with Construction Control Manual. Approval of testing facilities shall be based on compliance with ASTM E 548 and ASTM D 3740, and work requiring testing will not be permitted until approved by the Contracting Officer. All field density test results shall be reported in writing to the Contracting Officer no later than close of business the day following the test completion date.

3.8.1 Field Density with Moisture Content

Field in-place density with moisture content shall be determined in accordance with ASTM D 1556 and ASTM D 2216. Nuclear density and moisture content testing per ASTM D 2922 and ASTM D 3017 is allowed if adequate correlation with the sand cone can be determined. Every 5th nuclear test shall be verified by the sand cone test. If verification testing does not show adequate correlation as determined by the Contracting Officer, all tests shall be performed in accordance with ASTM D 1556. However, the Contractor may, at his option, perform all field density tests in accordance with ASTM D 1556.

3.8.2 Moisture-Density Relationships

Moisture-density relationships shall be determined by the test method outlined in ASTM D 1557, Procedure C.

3.8.3 Gradations, Atterberg Limits, and Classification

Gradation testing for soil materials shall be performed in accordance with ASTM D 422. Atterberg limits shall be determined by ASTM D 4318. Classification shall be determined by the test methods outlined ASTM D 2487.

3.8.4 Testing Schedule

Testing shall be as follows:

(a) Field Density with Moisture Content: For area fills, perform two tests per each increment or fraction of 1000 square yards placed during each 8 hour shift.

(b) Gradation with Atterberg Limits: From compacted material; one test for every 5 field density tests.

(c) Moisture-Density Relationship with Gradations, Atterberg Limits, and Classification: From a bulk sample; one set of tests for every 5 field density tests (with not less than one test for each type of material).

3.9 PROTECTION

Newly graded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades re established to the required elevations and slopes. All work shall be conducted in accordance with the environmental protection requirements of the contract.

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SECTION 02315

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

PART 1 GENERAL

1.1 SCOPE OF WORK

This section specifies final earthwork for building foundations and slabs-on-grade, with the exception of the underground utility earthwork in building areas, which is specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1995) Materials Finer Than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 136	(1996) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2217	(1985) Wet Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Constants
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

ASTM D 3740	(1996) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D 4318	(1995) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 548	(1991) Preparation of Criteria for Use in the Evaluation of Testing Laboratories and Inspection Bodies

CORPS OF ENGINEERS, SACRAMENTO DISTRICT (COE)

CESPK PAM 415-1-2	(1989) Construction Control Manual
EM 385-1-1	(1996) Safety and Health Requirements Manual

1.3 DEFINITIONS

1.3.1 Degree of Compaction

Degree of compaction is the ratio of the field dry density to the maximum dry density determined in the laboratory, expressed as a percentage. The laboratory maximum dry density shall be obtained according to ASTM D 1557, Procedure C.

1.3.2 Soil Classification Testing

Tests shall be performed by the Contractor for the determination of satisfactory material in accordance with the Construction Control Manual CESPK PAM 415-1-2. Certified test reports shall be furnished to the Contracting Officer for approval prior to use of the material. Materials shall be classified in accordance with ASTM D 2487. Gradations shall be determined in accordance with ASTM C 117 and ASTM C 136. Atterberg Limits shall be determined in conformance with ASTM D 4318, method A on samples prepared in accordance with ASTM D 2217.

1.3.3 Moisture Content

Moisture content is the ratio of the weight of the water to the weight of the solid matter expressed as a percentage and is determined by ASTM D 2216.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government: "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Field Density; G.

FIELD TESTING CONTROL

Satisfactory material; G.

All laboratory and field tests conducted in accordance with paragraph FIELD TESTING CONTROL. Certified test reports and analyses certifying that the select material conforms to the specified requirements.

1.5 SUBSURFACE DATA

Subsurface soil exploration logs are shown on the drawings. The data represent the best subsurface information available; however, variations may exist below surface between test hole locations.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Materials from on-site excavations that classify according to ASTM D 2487 as GW, GP, GC, GM, SW, SP, SC, SM, and combinations of these such as SP-SM, are satisfactory for fill and backfill for the project. In addition, satisfactory material shall have a maximum particle size of 2 inches and be free of organic material and debris.

2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Materials classified in accordance with ASTM D 2487 as CH, MH, CL, ML, Pt, OH, and OL are unsatisfactory.

PART 3 EXECUTION

3.1 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified hereinafter, and shall include foundation drainage systems to a point 5 feet beyond the building line of each building and structure, and all work incidental thereto. Trenching for utilities is specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Excavations below indicated depths will not be permitted except to remove unsatisfactory material.

3.1.1 Unsatisfactory Material Excavation

Unsatisfactory material encountered below the grades shown shall be removed as directed and replaced with properly compacted satisfactory material. No additional compensation shall be forthcoming for the excavation and replacement of materials rendered unsatisfactory by Contractor managed operations. A change in the Contract price shall be considered for incidents where unsatisfactory materials are encountered at depths and/or locations that are substantially different from those shown on the Contract Exploration Logs. Satisfactory material removed below the depths indicated without specific direction of the Contracting Officer shall be replaced at no additional cost to the Government to the indicated excavation grade with satisfactory materials. Satisfactory material shall be placed and

compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.2 DRAINAGE AND DEWATERING

3.2.1 Drainage

Surface water shall be directed away from excavation and construction sites so as to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained. No additional compensation shall be forthcoming for the removal and replacement of materials rendered unsatisfactory because of the Contractor's failure to adequately drain the site.

3.3 CLASSIFICATION OF EXCAVATION

Excavation will be unclassified regardless of the nature of material encountered. No additional compensation shall be forthcoming for the removal of rock or cemented soil materials.

3.4 BLASTING

Blasting will not be permitted.

3.5 EXCAVATED MATERIALS

Satisfactory excavated material shall be stockpiled and used for building fill and backfill. Satisfactory material in excess of that required for the permanent work and all soil that is unsatisfactory material and free of stripping and construction debris, i.e. clean fill, shall be disposed of on-post at designated sites for soil materials.

3.6 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

All foundation excavations shall be inspected and approved by the Contracting Officer prior to the placement of reinforcing steel and again immediately prior to the placement of foundation concrete. No steel or concrete shall be placed in excavations that contain unstable material, standing water, debris, or loose material.

3.7 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory material. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part cut or ungraded natural ground, the cut or ungraded natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill. Material shall not be placed

on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to plus or minus 2 percent of the optimum moisture content. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

3.8 FILLING AND BACKFILLING

Satisfactory material shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Place material in horizontal layers not exceeding 8 inches in loose thickness, or 6 inches when hand-operated compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade. Backfill shall not be placed in wet or frozen areas. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum dry density specified at plus or minus 2 percent of the optimum moisture content.

Percent Laboratory
maximum dry density

Fill and backfill

Under & around footings, and below slabs,
steps and ramps

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Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. No additional compensation shall be forthcoming for subgrade correction measures. Recomposition over underground utilities and heating lines shall be by hand tamping only.

3.9 FIELD TESTING CONTROL

Contractor quality control testing shall be performed in accordance with the Construction Control Manual, CESP K PAM 415-1-2 and as specified herein. Testing shall be the responsibility of the Contractor and shall be performed by an independent commercial testing laboratory in accordance with Construction Control Manual. Approval of testing facilities shall be based on compliance with ASTM E 548 and ASTM D 3740, and work requiring testing will not be permitted until approved by the Contracting Officer.

All field density test results shall be reported in writing to the Contracting Officer no later than close of business the day following the test completion date.

3.9.1 Field Density with Moisture Content

Field in-place density with moisture content shall be determined in accordance with ASTM D 1556 and ASTM D 2216. Nuclear density and moisture content testing per ASTM D 2922 and ASTM D 3017 is allowed if adequate correlation with the sand cone can be determined. Every 5th nuclear test shall be verified by the sand cone test. If verification testing does not show adequate correlation as determined by the Contracting Officer, all tests shall be performed in accordance with ASTM D 1556. However, the Contractor may, at his option, perform all field density tests in accordance with ASTM D 1556.

3.9.2 Moisture-Density Relationships

Moisture-density relationships shall be determined by the test method outlined in ASTM D 1557, Procedure C.

3.9.3 Gradations, Atterberg Limits, and Classification

Gradation testing for soil materials shall be performed in accordance with ASTM D 422. Atterberg limits shall be determined by ASTM D 4318. Classification shall be determined by the test methods outlined ASTM D 2487.

3.9.4 Testing Schedule

The following number of tests shall be the minimum acceptable for each type operation.

- a. Field Density and Moisture Content: For building pads, perform one test for each building pad. For curbing and medians, perform one test per 200 linear feet, measured linearly along the length of curbing or median. For isolated column footings, one random test during backfilling operations at each footing location.
- b. Moisture-Density Relationship with Gradation, Atterberg Limits, and Classification: From a bulk sample; one set of tests for every 5 field density tests (with not less than 1 test for each type of material) for the first 25 field density tests. Thereafter, one additional test for each change in material.
- c. Miscellaneous Granular Materials: A minimum of two compressive strength tests shall be performed for each source of controlled low strength material.

3.10 GRADING

Areas within 5 feet outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

3.11 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas

prior to acceptance of the work shall be repaired and grades reestablished to the required elevations and slopes.

-- End of Section --

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SECTION 02316

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

This section specifies all earthwork for underground utilities systems.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN CONCRETE INSTITUTE

ACI 229R (1994) Controlled Low Strength Materials

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33 (1993) Concrete Aggregates

ASTM C 39 (1986) Compressive Strength of Cylindrical Concrete Specimens

ASTM C 117 (1990) Materials Finer Than 75-um (No.200) Sieve in Mineral Aggregates by Washing

ASTM C 136 (1993) Sieve Analysis of Fine and Coarse Aggregates

ASTM C 150 (1996) Portland Cement

ASTM D 422 (1963; R 1990) Particle-Size Analysis of Soils

ASTM D 1556 (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))

ASTM D 2216 (1992) Laboratory Determination of Water(Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures

ASTM D 2217 (1985) Wet Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Constants

ASTM D 2487 (1992;R 1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 3740	(1992) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D 4318	(1984) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4832	(1995) Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

CORPS OF ENGINEERS, SACRAMENTO DISTRICT (COE)

CESPK PAM 415-1-2	(1989) Construction Control Manual
EM 385-1-1	(1996) Safety and Health Requirements Manual

1.3 DEFINITIONS

1.3.1 Degree of Compaction

Degree of compaction is the ratio of the field dry density to the maximum dry density determined in the laboratory, expressed as a percentage. The laboratory maximum dry density shall be obtained according to ASTM D 1557, Procedure C.

1.3.2 Soil Classification Testing

Tests shall be performed by the Contractor for the determination of satisfactory material in accordance with CESPK PAM 415-1-2, the Construction Control Manual. Certified test reports shall be furnished to the Contracting Officer for approval prior to use of the material. Materials shall be classified in accordance with ASTM D 2487. Gradations shall be determined in accordance with ASTM C 117 and ASTM C 136. Atterberg Limits shall be determined in conformance with ASTM D 4318, method A on samples prepared in accordance with ASTM D 2217.

1.3.3 Moisture Content

Moisture content is the ratio of the weight of the water to the weight of the solid matter expressed as a percentage and is determined by ASTM D 2216.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government: "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Field Testing Control Initial Backfill Materials; G.

All laboratory and field tests conducted in accordance with paragraph FIELD

TESTING CONTROL. Test reports and analyses certifying that the materials proposed for use at the project site conform to the specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Materials from on-site excavations that classify according to ASTM D 2487 as GW, GP, GC, GM, SW, SP, SC, SM, and combinations of these such as SP-SM, are satisfactory for fill and backfill for the project. In addition, satisfactory material shall have a maximum particle size of 2 inches and be free of organic material and debris.

2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Materials classified in accordance with ASTM D 2487 as CH, MH, CL, ML, Pt, OH and OL are unsatisfactory.

2.1.2.1 Unyielding Material

Unyielding material shall consist of rock and dense or cemented soils which require trackhoe sized equipment for excavation. Unyielding materials may exist on this site; no additional compensation shall be forthcoming for the excavation of unyielding materials.

2.1.3 Initial Backfill Materials

Initial backfill material shall consist of the material specified by the conduit or coating manufacturer for the particular trench configuration and loading condition. In the absence of a conduit or coating manufacturer's specifications, initial backfill shall consist of select granular material, controlled low strength material or sand. Select granular material shall be used for bridging and general bedding and initial backfill. Controlled low strength material shall be used for bridging and bedding and initial backfill under heavily loaded areas and buildings. Sand shall be used as bedding and initial backfill for conduits that are coated for corrosion protection.

2.1.3.1 Select Granular Material

Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles. The material shall be graded per ASTM C 33, size number 67.

2.1.3.2 Controlled Low Strength Material

Controlled low strength material (CLSM) shall consist of a lean concrete mix conforming to the following:

- a. The requirements of ACI 229R.
- b. Type II portland cement in accordance with ASTM C 150.
- c. Size 57 concrete coarse aggregate in accordance with ASTM C 33.
- d. A compressive strength at 28 days between 80 and 150 psi in

accordance with ASTM D4832.

2.1.3.3 Sand

Sand shall conform to ASTM C 33 requirements for concrete fine aggregate. Additionally, sand shall have an in place water content of less than 7 percent as determined by ASTM D 2216.

2.1.4 Plastic Marking Tape

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6-inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise, and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Blue:	Water Systems
Green:	Sewer Systems

PART 3 EXECUTION

3.1 EXCAVATION

Excavation shall be performed to the lines and grades indicated. While excavating, material that is satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site and disposed of by the Contractor at a designated Fort Irwin disposal site prior to the completion of construction. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. No additional compensation shall be forthcoming for the excavation and replacement of materials from unauthorized overexcavation or materials rendered unsatisfactory by Contractor managed operations. No additional compensation shall be forthcoming for material excavation and replacement due to the Contractor's failure to protect, drain, or dewater the project site. A change in the Contract price shall be considered for incidents where unsatisfactory materials are not the result of Contractor managed operations and are encountered at depths and/or locations that are substantially different from those shown on the Contract Exploration Logs.

3.1.1 Trench Excavation

The trench shall be excavated as recommended by the manufacturer of the conduit to be installed. Trench walls below the top of the pipe shall be

sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than 5 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 5 feet high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. Trenches shall be excavated to the width specified by the conduit manufacturer for the particular depth and loading condition. In the absence of manufacturer specifications the trench shall be excavated to provide a clearance of 3 to 6 inches between the trench wall and the in place conduit. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government. All trench walls shall be in compliance with the Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1.

3.1.1.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom of each section of the conduit. Stones that are 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, shall be removed to prevent point bearing. Excavation shall be deep enough to provide clearance between the trench and conduit bottoms for the bedding.

3.1.1.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, such material shall be removed to the depth required to provide sufficient clearance for the conduit bedding.

3.1.1.3 Excavation for Appurtenances

Excavation for manholes, catch-basins, underground tanks, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.1.1.4 Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections. The Contractor shall vertically and horizontally locate all underground utilities in the vicinity of the operation and shall repair any broken or damaged utilities or pavements at no cost to the Government. The Contractor shall obtain all permits and clearances for the operation. All excavations shall be completely backfilled, compacted, and graded upon completion of testing.

3.1.1.5 Stockpiles

Stockpiles of satisfactory, unsatisfactory, and waste materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government. Locations of stockpiles of satisfactory materials shall be subject to prior approval of the Contracting Officer.

3.2 BACKFILLING AND COMPACTION

Backfill material shall consist of satisfactory material and initial backfill material as required. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to densities specified hereinafter.

3.2.1 Trench Backfill

Trenches shall be backfilled to the grade shown. The trench shall be backfilled to 2 feet above the top of pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test and thrust blocks shall be allowed to cure for 48 hours prior to testing. Backfilling shall not be completed until all specified tests are performed and passed.

3.2.1.1 Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with initial backfill material.

3.2.1.2 Bedding and Initial Backfill

Bedding shall consist of initial backfill material placed to the thickness shown. Care shall be taken to ensure thorough compaction of the bedding under the haunches of the pipe. Initial backfill material shall be placed and compacted with approved tampers to a height of at least 12 inches above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Initial backfill shall be placed in 4 inch loose lifts, each lift compacted with an approved hand-operated vibratory plate-type compactor until no additional surface elevation changes occur.

3.2.1.3 Final Backfill

The remainder of the trench, except for special materials for roadways, shall be filled with satisfactory material. Placed conduits shall be protected from crushing by construction vehicles during subsequent construction operations. The Contractor shall repair damaged lines at no additional cost to the Government. Backfill material shall be placed and compacted as follows:

a. Under Buildings: Backfill shall be placed and compacted to a minimum of 95 percent of the maximum laboratory dry density, full depth. Water flooding or jetting methods of compaction will not be permitted.

b. Under Pavements, Sidewalks and Miscellaneous Areas: Backfill shall be deposited and compacted to 95 percent of the maximum laboratory dry density, except that the top 6 inches in landscaped areas shall be compacted to 90 percent. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

3.2.2 Backfill for Appurtenances

Appurtenant structures shall be backfilled with satisfactory material. After the manhole, catch basin, underground tank, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 7 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.3 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.3.1 Water Lines

Trenches shall be of a depth to provide a minimum cover of 2 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.3.2 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 2 feet from the finished grade, unless otherwise indicated.

3.3.3 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 18 inches below finished grade unless otherwise shown.

3.4 FIELD TESTING CONTROL

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory subject to approval and meeting the requirements specified in ASTM D 3740.

3.4.1 In-Place Densities

Field in-place density with moisture content shall be determined in accordance with ASTM D 1556 and ASTM D 2216. Nuclear density and moisture content testing per ASTM D 2922 and ASTM D 3017 is allowed if adequate correlation with the sand cone can be determined. Every 5th nuclear test shall be verified by the sand cone test. If verification testing does not show adequate correlation as determined by the Contracting Officer, all

tests shall be performed in accordance with ASTM D 1556. However, the Contractor may, at his option, perform all field density tests in accordance with ASTM D 1556.

3.4.2 Moisture-Density Relationships

Moisture-density relationships shall be determined by the test method outlined in ASTM D 1557, Procedure C.

3.4.3 Gradation, Atterberg Limits, and Classification

Gradation testing aggregates shall be performed by the test method outlined in ASTM C 136. Gradation testing for soil materials shall be performed in accordance with ASTM D 422. Atterberg limits shall be determined by ASTM D 4318. Classification shall be determined by the test method outlined in ASTM D 2487.

3.4.4 Miscellaneous Testing

Sieve size analysis for the sand and controlled low-strength material aggregate shall be performed in accordance with ASTM C 136.

3.4.5 Testing Schedule

The following number of tests shall be the minimum acceptable for each type operation.

(a) Field Density and Moisture Content: For utility trenches, perform one test for each lift or each increment or fraction of 200 feet, measured linearly along the length of trench. For isolated utility appurtenances, one random test during backfilling operations at each location.

(b) Moisture-Density Relationship with Gradation, Atterberg Limits, and Classification: From a bulk sample; one set of tests for every 5 field density tests (with not less than 1 test for each type of material) for the first 25 field density tests. Thereafter, one additional test for each change in material.

(c) Miscellaneous Granular Materials: For select granular material and controlled low-strength material aggregate; perform a minimum of two random sieve size analyses for each material source. Perform a minimum of two sieve size analyses and two water content tests for in place sand, if used for bedding and initial backfill. A minimum of two compressive strength tests shall be performed for each source of controlled low strength material.

3.5 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to 2 feet above the top of the pipe, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 36 inches shall be entered and examined. Pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

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SECTION 02530

SANITARY SEWERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

- | | |
|-------------|--|
| ACPA 01-102 | (1988) Concrete Pipe Handbook |
| ACPA 01-103 | (1995) Concrete Pipe Installation Manual |

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|-----------------|--|
| ANSI B18.5.2.1M | (1981; R 1995) Metric Round Head Short Square Neck Bolts |
|-----------------|--|

AMERICAN RAILWAY ENGINEERING & MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

- | | |
|-----------|------------------|
| AREMA 1-5 | (2001) Pipelines |
|-----------|------------------|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------------|---|
| ASTM A 123/A 123M | (2001a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM A 307 | (2000) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength |
| ASTM A 47 | (1999) Ferritic Malleable Iron Castings ** |
| ASTM A 47M | (1990; R 1996) Ferritic Malleable Iron Castings (Metric) ** |
| ASTM A 48 | (1994ae1) Gray Iron Castings ** |
| ASTM A 48M | (1994e1) Gray Iron Castings (Metric) ** |
| ASTM A 536 | (1984; R 1999e1) Ductile Iron Castings |
| ASTM A 563 | (2000) Carbon and Alloy Steel Nuts |
| ASTM A 563M | (2001) Carbon and Alloy Steel Nuts (Metric) |
| ASTM A 74 | (1998) Cast Iron Soil Pipe and Fittings |
| ASTM A 746 | (1999) Ductile Iron Gravity Sewer Pipe |
| ASTM C 12 | (2002) Installing Vitrified Clay Pipe Lines |

ASTM C 14	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 14M	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
ASTM C 150	(2002) Portland Cement
ASTM C 260	(2001) Air-Entraining Admixtures for Concrete
ASTM C 270	(2001a) Mortar for Unit Masonry
ASTM C 33	(2001a) Concrete Aggregates
ASTM C 361	(1999) Reinforced Concrete Low-Head Pressure Pipe
ASTM C 361M	(1999) Reinforced Concrete Low-Head Pressure (Metric)
ASTM C 425	(2002) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443	(2001) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 443M	(2001) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric)
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C 564	(1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 700	(2002) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 76	(2000) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 76M	(2000) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 828	(2001) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 923	(2000) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C 923M	(1998) Resilient Connectors Between Reinforced Concrete Manhole Structures,

Pipes and Laterals (Metric)

ASTM C 924	(1989; R 1997) Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 924M	(1989; R 1998) Testing Concrete Pipe Sewer Liner by Low-Pressure Air Test Method (Metric)
ASTM C 94	(1994) Ready-Mixed Concrete **
ASTM C 94/C 94M	(2000e2) Ready-Mixed Concrete
ASTM C 969	(2000) Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 969M	(2000) Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)
ASTM C 972	(2000) Compression-Recovery of Tape Sealant
ASTM C 990	(2001a) Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealers
ASTM C 990M	(2001a) Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants (Metric)
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2235	(2001) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2241	(2000) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2321	(2000) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2412	(1996a) Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2001) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40

ASTM D 2467	(2001) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2680	(2001) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 2996	(2001) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 2997	(2001) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3034	(2000) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3262	(2002) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
ASTM D 3350	(2002) Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3753	(1999) Glass-Fiber-Reinforced Manholes
ASTM D 3840	(2001) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications
ASTM D 4101	(2002) Propylene Injection and Extrusion Materials
ASTM D 412	(1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 4161	(2001) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM D 624	(2000) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM F 402	(1993; R 1999) Safe Handling of Solvent Cements, Primers, and Cleaners Used for

Joining Thermoplastic Pipe and Fittings

ASTM F 405	(1997) Corrugated Polyethylene (PE) Tubing and Fittings
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 714	(2001) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F 758	(1995; R 2000) Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F 794	(1999) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 894	(1998a) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F 949	(2001a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105	(1999) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1999) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C153	(2000) Ductile-Iron Compact Fittings for Water Service
AWWA C302	(1995) Reinforced Concrete Pressure Pipe, Noncylinder Type
AWWA C600	(1999) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA C900	(1997) Polyvinyl Chloride (PVC) Pressure

Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution

AWWA M23 (1980) Manual: PVC Pipe - Design and Installation

AWWA M9 (1995) Manual: Concrete Pressure Pipe

ASME INTERNATIONAL (ASME)

ASME B1.20.1 (1983; R 2001) Pipe Threads, General Purpose, Inch

ASME B16.1 (1998) Cast Iron Pipe Flanges and Flanged Fittings

ASME B18.2.2 (1987; R 1999) Square and Hex Nuts

ASME B18.5.2.2M (1982; R 2000) Metric Round Head Square Neck Bolts

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301 (2000) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

CISPI 310 (1997) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005 (1998) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole ++

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.27 Fixed Ladders

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3 (1992) Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 Inch)

UBPPA UNI-B-6 (1990) Recommended Practice for the Low-Pressure Air Testing of Installed Sewer Pipe

1.2 [Enter Appropriate Subpart Title Here] 1.3 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified

in Section 02316A EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pipeline materials including joints, fittings, and couplings

Submit manufacturer's standard drawings or catalog cuts.

SD-07 Certificates

Portland Cement; [____], [____]

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

Joints; [____], [____]

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable

materials.

1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Carry, do not drag, pipe to trench.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 ABS Composite Plastic Piping

2.1.1.1 ABS Composite Plastic Pipe and Fittings

ASTM D 2680.

2.1.1.2 Jointing Materials for ABS Composite Plastic Piping

Solvent cement and primer shall conform to ASTM D 2680.

2.1.2 ABS Solid-Wall Plastic Piping

2.1.2.1 ABS Solid-Wall Plastic Pipe and Fittings

ASTM D 2751, SDR 35, with ends suitable for either solvent cement joints or elastomer joints.

2.1.2.2 ABS Solid-Wall Plastic Joints and Jointing Materials

Solvent cement for solvent cement joints shall conform to ASTM D 2235. Elastomeric joints shall conform to ASTM D 3212. Gaskets for elastomeric joints shall conform to ASTM F 477.

2.1.3 PVC Plastic Gravity Sewer Piping

2.1.3.1 PVC Plastic Gravity Pipe and Fittings

ASTM D 3034, SDR 35, or ASTM F 949 with ends suitable for elastomeric gasket joints.

2.1.3.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

2.2 CONCRETE MATERIALS

2.2.1 Cement Mortar

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.2.2 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in

concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94/C 94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psiminimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.
Text

2.3 MISCELLANEOUS MATERIALS

2.3.1 Precast Concrete Manholes

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C 478; base and first riser shall be monolithic.

2.3.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C 443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C 923 or ASTM C 990.

2.3.3 External Preformed Rubber Joint Seals

An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Propylene Di Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting rings. Properties and valves are listed in the following tables:

[Properties, Test Methods and Minimum Values for
Rubber used in Preformed Joint Seals

Physical Properties	Test Methods	EPDM	Neoprene	Butyl mastic
Tensile, psi	ASTM D 412	1840	2195	-
Elongation percent	ASTM D 412	553	295	350
Tear Resistance, ppi	ASTM D 624 (Die B)	280	160	-
Rebound, percent, 5 minutes	ASTM C 972 (mod.)	-	-	11

[Properties, Test Methods and Minimum Values for
Rubber used in Preformed Joint Seals

Physical Properties	Test Methods	EPDM	Neoprene	Butyl mastic
Rebound, percent, 2 hours	ASTM C 972	-	-	12]

2.3.4 Metal Items

2.3.4.1 Frames, Covers, and Gratings for Manholes

FS A-A-60005, cast iron; figure numbers shall be [as follows] [as indicated]:

- a. Traffic manhole: Provide in paved areas.

Frame: Figure 1, Size 22A
Cover: Figure 8, Size 22A
Steps: Figure 19

- b. Non-traffic manhole:

Frame: Figure 4, Size 22
Cover: Figure 12, Size 22
Steps: Figure 19

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. Reinforced concrete frames and covers shall be as indicated or shall conform to ASTM C 478 or ASTM C 478M. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.3.4.2 Manhole Steps

Zinc-coated steel conforming to 29 CFR 1910.27. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less than 4 feet deep.

2.3.4.3 Septic Tank Piping

PVC Piping.

2.3.4.4 Siphon for Septic Tank

Welded steel or close-grained cast iron free from flaws, of an approved standard design, and prompt and positive in action.

2.3.5 Sewage Absorption Field Materials

Pipe shall be perforated bell-and-spigot PVC plastic pipe conforming to ASTM F 758.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

Apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building , unless otherwise indicated. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 10 feet to a water main or service line.

Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section [02316, "Excavation, Trenching, And Backfilling for Utilities.."]

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 Installation of ABS Composite Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General

Requirements for Installation of Pipelines" of this section and with the recommendations of the plastic pipe manufacturer. Make joints with the primer and solvent cement specified for this joint and assemble in accordance with the recommendations of the pipe manufacturer. Handle solvent cement in accordance with ASTM F 402.

3.1.2.2 Installation of ABS Solid-Wall Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the recommendations of the plastic pipe manufacturer. Make solvent cement joints with the solvent cement previously specified for this type joint. Make elastomeric joints with the gaskets specified for this type joint and assemble in accordance with the recommendations of the pipe manufacturer. Handle solvent cement in accordance with ASTM F 402.

3.1.2.3 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.3 Concrete Work

The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.1.4 Manhole Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

3.1.5 Miscellaneous Construction and Installation

3.1.5.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.1.5.2 Metal Work

- a. Workmanship and finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.
- b. Field painting: After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

3.1.6 Sewage Absorption Trench Construction

Grade pipe lines uniformly downward to the outlet. Lay perforated pipe with the perforations downward. Lay drain tile with 1/4 inch open joints. Cover open joints of drain tile with the cover material specified so that it extends not less than 100 degrees on each side of the vertical center line of the tile. Wire covering in place.

3.1.7 Installations of Wye Branches

Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Tests for Nonpressure Lines

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line. When pressure piping is used in a nonpressure line for nonpressure use, test this piping as specified for nonpressure pipe.

3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

- a. Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in accordance with ASTM C 969. Make calculations in accordance with the Appendix to ASTM C 969.

- b. Low-pressure air tests: Perform tests as follows:

- (4) ABS composite plastic pipelines: Test in accordance with the applicable requirements of UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

- (5) PVC plastic pipelines: Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

-- End of Section --

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SECTION 02722A

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SECTION 02722A

AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 180 (1997) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457 mm (18-in) Drop

AASHTO T 224 (1996) Correction for Coarse Particles in the Soil Compaction Test

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M (1997) Bulk Density ("Unit Weight") and Voids in Aggregates

ASTM C 88 (1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C 117 (1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C 127 (1988; R 1993el) Specific Gravity and Absorption of Course Aggregate

ASTM C 128 (1997) Specific Gravity and Absorption of Fine Aggregate

ASTM C 131 (1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C 136 (1996a) Sieve Analysis of Fine and Coarse Aggregates

ASTM D 75 (1987; R 1997) Sampling Aggregates

ASTM D 422 (1963; R 1998) Particle-Size Analysis of Soils

ASTM D 1556 (2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3740	(1992) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D 1557.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools

List of proposed equipment to be used in performance of construction work, including descriptive data.

SD-06 Test Reports

Sampling and testing; G
Field Density Tests

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 30 days before material is required for the work.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by a testing laboratory approved in accordance with ASTM D 3740. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at the specified frequency. The Contracting Officer may specify the time and location of the tests. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of the tests.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11.

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.4.2.3 Moisture-Density Determinations

The maximum density and optimum moisture content shall be determined in accordance with ASTM D 1557.

1.4.2.4 Field Density Tests

Density shall be field measured in accordance with ASTM D 1556. For the method presented in ASTM D 1556 the base plate as shown in the drawing shall be used.

1.4.2.5 Wear Test

Wear tests shall be made on ABC course material in conformance with ASTM C 131.

1.4.3 Testing Frequency

1.4.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Sieve Analysis.
- b. Liquid limit and plasticity index.
- c. Moisture-density relationship.
- d. Wear.

1.4.3.2 In Place Tests

Each of the following tests shall be performed on samples taken from the placed and compacted ABC. Samples shall be taken and tested at the rates indicated.

- a. Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every 300 square yards, or portion thereof, of completed area during each 8 hour shift.
- b. Sieve Analysis shall be performed for every 500 tons, or portion thereof, of material placed.
- c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.

1.4.3.3 Wear Tests

One wear test shall be run for every five field density tests, with not less than one test for each type of material.

1.4.4 Approval of Material

The source of the material shall be selected 30 days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted ABC.

1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in

satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 AGGREGATES

The ABC shall consist of clean, sound, durable particles of crushed stone, crushed gravel, angular sand, or other approved material. ABC shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.

2.1.1 Coarse Aggregate

Only one type of coarse aggregate shall be used on the project. Coarse aggregates shall be angular particles of uniform density and quality. ABC coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3.

a. Crushed Gravel: Crushed gravel shall be manufactured by crushing gravels, and shall meet all the requirements specified below. Crushed gravel shall be manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed in TABLE 1.

b. Crushed Stone: Crushed stone shall consist of freshly mined quarry rock, and shall meet all the requirements specified below. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces.

2.1.2 Fine Aggregate

Fine aggregates shall be angular particles of uniform density. When the fine aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements. ABC fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

2.1.3 Gradation Requirements

The specified gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of 1 inch and shall be continuously well graded within the limits specified in TABLE 1. Sieves shall conform to ASTM E 11.

TABLE I. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	

1 inch	100
3/4 inch	90-100
No. 4	35-60
No. 30	10-30
No. 200	2-9

NOTE 1: Particles having diameters less than 0.0008 inch shall not be in excess of 3 percent by weight of the total sample tested.

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C 127 and ASTM C 128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Contracting Officer.

NOTE 3: Aggregate is similar to Class 2 Aggregate, 19-mm Maximum, Section 26 of the State of California Standard Specifications.

2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements shall apply to the completed course and shall also apply to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the No. 40 sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the ABC is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Aggregates shall be obtained from offsite sources.

3.3 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the

cleared and leveled areas designated by the Contracting Officer to prevent segregation.

3.4 PREPARATION OF UNDERLYING COURSE

Prior to constructing the ABC, the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the ABC, the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to Section 02300 EARTHWORK.

Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompact to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the ABC.

Stabilization shall be accomplished by mixing ABC into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the ABC is placed.

3.5 INSTALLATION

3.5.1 Mixing the Materials

The coarse and fine aggregates shall be mixed in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. The Contractor shall make adjustments in mixing procedures or in equipment as directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory ABC meeting all requirements of this specification.

3.5.2 Placing

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 6 inches or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 6 inches is required, the material shall be placed in layers of equal thickness. No layer shall exceed 6 inches or less than 3 inches when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the ABC is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable ABC.

3.5.3 Grade Control

The finished and completed ABC shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required ABC thickness so that the finished ABC with the subsequent surface course will meet the designated

grades.

3.5.4 Edges of Base Course

The ABC shall be placed so that the completed section will be a minimum of 5 feet wider, on all sides, than the next layer that will be placed above it. Additionally, approved fill material shall be placed along the outer edges of ABC in sufficient quantities to compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 2 foot width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of ABC. If this base course material is to be placed adjacent to another pavement section, then the layers for both of these sections shall be placed and compacted along this edge at the same time.

3.5.5 Compaction

Each layer of the ABC shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 2 percent of the optimum water content determined from laboratory tests as specified in paragraph SAMPLING AND TESTING. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer has a degree of compaction that is at least 98 percent of laboratory maximum dry density through the full depth of the layer. The Contractor shall refer to the plans for locations where the base course is to be constructed in two layers, with to upper layer requiring a compaction of 100 percent of laboratory maximum dry density. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory ABC. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.5.6 Thickness

Compacted thickness of the aggregate course shall be as indicated. No individual layer shall exceed 6 inches nor be less than 3 inches in compacted thickness. The total compacted thickness of the ABC course shall be within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated. The total thickness of the ABC course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square yards of base course. Thickness measurements shall be made by taking differential elevations at preselected points between the subgrade and the completed aggregate base course.

3.5.7 Finishing

The surface of the top layer of ABC shall be finished after final compaction and proof rolling by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of ABC is 1/2 inch or more below grade, then the top layer should be scarified to a depth of at least 3 inches and new material shall be blended in and compacted to bring to grade. Adjustments to rolling and finishing procedures shall be made as directed to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, reworked and recompacted or it shall be replaced as directed.

3.5.8 Smoothness

The surface of the top layer shall show no deviations in excess of 3/8 inch when tested with a 12-foot straightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 50-foot intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.6 TRAFFIC

Traffic shall not be allowed on the completed ABC course.

3.7 MAINTENANCE

The ABC shall be maintained in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any ABC that is not paved over prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of ABC that is damaged shall be reworked or replaced as necessary to comply with this specification.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of as directed by the Contracting Officer. No additional payments will be made for materials that must be replaced.

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-- End of Section Table of Contents --

SECTION 02741A

HOT-MIX ASPHALT (HMA) FOR ROADS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO MP 1	(1998) Provisional Specification for Performance Graded Asphalt Binder
AASHTO MP 2	(1998; Interim 1999) Superpave Volumetric Mix Design
AASHTO TP53	(1998; Interim 1999) Determining Asphalt Content of Hot Mix Asphalt by the Ignition Method

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M	(1997) Bulk Density ("Unit Weight") and Voids in Aggregates
ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 566	(1997) Evaporable Total Moisture Content of Aggregate by Drying
ASTM C 1252	(1998) Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading)
ASTM D 140	(1998) Sampling Bituminous Materials

ASTM D 242	(1995) Mineral Filler for Bituminous Paving Mixtures
ASTM D 946	(1999) Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 995	(1995b) Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
ASTM D 1461	(1985)) Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D 1559	(1989) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D 2041	(1995) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2172	(1995) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2419	(1995) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 2489	(1984; R 1994el) Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D 2726	(1996el) Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixture
ASTM D 2950	(1997) Density of Bituminous Concrete in Place by Nuclear Method
ASTM D 3381	(1999) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 3665	(1999) Random Sampling of Construction Materials
ASTM D 3666	(1998) Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials
ASTM D 4125	(1994el)Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D 4791	(1999) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D 4867/D 4867M	(1996) Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D 5444	(1998) Mechanical Size Analysis of Extracted Aggregate

ASTM D 6307 (1998) Asphalt Content of Hot Mix Asphalt
by Ignition Method

ASPHALT INSTITUTE (AI)

AI MS-2 (1997) Mix Design Methods for Asphalt
Concrete and Other Hot-Mix Types

AI MS-22 (1998; 2nd Edition) Construction of
Hot-Mix Asphalt Pavements

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CDT)

CDT Test 526 (1978) Operation of California
Profilograph and Evaluation of Profiles

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 171 (1995) Test Method for Determining
Percentage of Crushed Particles in
Aggregate

1.2 DESCRIPTION OF WORK

The work shall consist of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. HMA designed and constructed in accordance with this section shall conform to the lines, grades, thicknesses, and typical cross sections shown on the drawings. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mix Design; G.

Proposed JMF.

Contractor Quality Control; G.

Quality control plan.

Material Acceptance; G.

Acceptance test results.

SD-04 Samples

Asphalt Cement Binder.

(5 gallon) sample for mix design verification.

Aggregates.

Sufficient materials to produce 200 lb of blended mixture for mix design verification.

SD-06 Test Reports

Aggregates; G.
QC Monitoring; G.

Aggregate and QC test results.

SD-07 Certificates

Asphalt Cement Binder; G.

Copies of certified test data.

Testing Laboratory; G.

Certification of compliance.

Plant Scale Calibration Certification

1.4 ASPHALT MIXING PLANT

Plants used for the preparation of hot-mix asphalt shall conform to the requirements of ASTM D 995 with the following changes:

a. Truck Scales. The asphalt mixture shall be weighed on approved certified scales at the Contractor's expense. Scales shall be inspected and sealed at least annually by an approved calibration laboratory.

b. Testing Facilities. The Contractor shall provide laboratory facilities at the plant for the use of the Government's acceptance testing and the Contractor's quality control testing.

c. Inspection of Plant. The Contracting Officer shall have access at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. The Contractor shall provide assistance as requested, for the Government to procure any desired samples.

d. Storage Bins. Use of storage bins for temporary storage of hot-mix asphalt will be permitted as follows:

(1) The asphalt mixture may be stored in non-insulated storage bins for a period of time not exceeding 3 hours.

(2) The asphalt mixture may be stored in insulated storage bins for a period of time not exceeding 8 hours. The mix drawn from bins shall meet the same requirements as mix loaded directly into trucks.

1.5 HAULING EQUIPMENT

Trucks used for hauling hot-mix asphalt shall have tight, clean, and smooth

metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Petroleum based products shall not be used as a release agent. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers (tarps) shall be securely fastened.

1.6 ASPHALT PAVERS

Asphalt pavers shall be self-propelled, with an activated screed, heated as necessary, and shall be capable of spreading and finishing courses of hot-mix asphalt which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

1.6.1 Receiving Hopper

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

1.6.2 Automatic Grade Controls

If an automatic grade control device is used, the paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. A transverse slope controller shall not be used to control grade.

The controls shall be capable of working in conjunction with any of the following attachments:

- a. Ski-type device of not less than 30 feet in length.
- b. Taut stringline set to grade.
- c. Short ski or shoe for joint matching.
- d. Laser control.

1.7 ROLLERS

Rollers shall be in good condition and shall be operated at slow speeds to avoid displacement of the asphalt mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. Equipment which causes excessive crushing of the aggregate shall not be used.

1.8 WEATHER LIMITATIONS

The hot-mix asphalt shall not be placed upon a wet surface or when the

surface temperature of the underlying course is less than specified in Table 1. The temperature requirements may be waived by the Contracting Officer, if requested; however, all other requirements, including compaction, shall be met.

Table 1. Surface Temperature Limitations of Underlying Course

<u>Mat Thickness, inches</u>	<u>Degrees F</u>
3 or greater	40
Less than 3	45

PART 2 PRODUCTS

2.1 AGGREGATES

Aggregates shall consist of crushed stone, crushed gravel, and natural sand and mineral filler, as required. The portion of material retained on the No. 4 sieve is coarse aggregate. The portion of material passing the No. 4 sieve and retained on the No. 200 sieve is fine aggregate. The portion passing the No. 200 sieve is defined as mineral filler. All aggregate test results and samples shall be submitted to the Contracting Officer at least 14 days prior to start of construction.

2.1.1 Coarse Aggregate

Coarse aggregate shall consist of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. All individual coarse aggregate sources shall meet the following requirements:

- a. The percentage of loss shall not be greater than 40 percent after 500 revolutions when tested in accordance with ASTM C 131.
- b. The percentage of loss shall not be greater than 18 percent after five cycles when tested in accordance with ASTM C 88 using magnesium sulfate.
- c. At least 75 percent by weight of coarse aggregate shall have at least two or more fractured faces when tested in accordance with COE CRD-C 171. Fractured faces shall be produced by crushing.
- d. The particle shape shall be essentially cubical and the aggregate shall not contain more than 20% percent, by weight, of flat and elongated particles (3:1 ratio of maximum to minimum) when tested in accordance with ASTM D 4791.

2.1.2 Fine Aggregate

Fine aggregate shall consist of clean, sound, tough, durable particles. The aggregate particles shall be free from coatings of clay, silt, or any objectionable material and shall contain no clay balls. All individual fine aggregate sources shall have a sand equivalent value not less than 45 when tested in accordance with ASTM D 2419.

The fine aggregate portion of the blended aggregate shall have an uncompacted void content not less than 43.0 percent when tested in

accordance with ASTM C 1252 Method A.

2.1.3 Mineral Filler

Mineral filler shall be nonplastic material meeting the requirements of ASTM D 242.

2.1.4 Aggregate Gradation

The combined aggregate gradation shall conform to gradations specified in Table 2, when tested in accordance with ASTM C 136 and ASTM C 117, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grade uniformly from coarse to fine. Gradation shall be similar to the gradation specified in Section 39 of the State of California Department of Transportation Standard Specifications for the 19-mm Maximum, Medium size and shall fall within the limits listed below. In the table below, the symbol "X" is the gradation that the Contractor proposes to furnish for the specific sieve. The proposed gradation shall meet the gradation shown in the table under "Limits of Proposed Gradation". Changes from one mix design to another shall not be made during the progress of the work unless permitted by the Contracting Officer. However, changes in proportions to conform to the approved mix design shall not be considered changes to the mix design.

Table 2. Aggregate Gradations

Sieve Size, U.S.	Percent Passing by Weight		
	Limits of Proposed Gradation	Operating Range	Contract Compliance
1-inch	-	100	100
3/4-inch	-	95-100	90-100
3/8-inch	-	65-80	60-85
No. 4	49-54	X+/-5	X+/-8
No. 8	36-40	X+/-5	X+/-8
No. 30	18-21	X+/-5	X+/-8
No. 200	-	3-8	0-11

2.2 ASPHALT CEMENT BINDER

Asphalt cement binder shall conform to ASTM D 3381 Table 2, Viscosity Grade **AR 4000**. Test data indicating grade certification shall be provided by the supplier at the time of delivery of each load to the mix plant. Copies of these certifications shall be submitted to the Contracting Officer. The supplier is defined as the last source of any modification to the binder. The Contracting Officer may sample and test the binder at the mix plant at any time before or during mix production. Samples for this verification testing shall be obtained by the Contractor in accordance with ASTM D 140 and in the presence of the Contracting Officer. These samples shall be furnished to the Contracting Officer for the verification testing, which shall be at no cost to the Contractor. Samples of the asphalt cement specified shall be submitted for approval not less than 14 days before start of the test section.

2.3 MIX DESIGN

The Contractor shall develop the mix design. The asphalt mix shall be composed of a mixture of well-graded aggregate, mineral filler if required, and asphalt material. The aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF). No hot-mix asphalt for payment shall be produced until a JMF has been approved. The hot-mix asphalt shall be designed using procedures contained in AI MS-2 and the criteria shown in Table 3. If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D 4867/D 4867M is less than 75, the aggregates shall be rejected or the asphalt mixture treated with an approved anti-stripping agent. The amount of anti-stripping agent added shall be sufficient to produce a TSR of not less than 75. If an antistrip agent is required, it shall be provided by the Contractor at no additional cost. Sufficient materials to produce 200 pounds of blended mixture shall be provided to the Contracting Officer for verification of mix design at least 14 days prior to construction of test section.

At the option of the contractor a currently used DOT superpave hot mix may be used in lieu of developing a new hot mix design study as described herein. The superpave volumetric mix shall be designed in accordance with AASHTO MP 2.

2.3.1 JMF Requirements

The job mix formula shall be submitted in writing by the Contractor for approval at least 14 days prior to the start of the test section and shall include as a minimum:

- a. Percent passing each sieve size.
- b. Percent of asphalt cement.
- c. Percent of each aggregate and mineral filler to be used.
- d. Asphalt viscosity grade, penetration grade, or performance grade.
- e. Number of blows of hammer per side of molded specimen.
- f. Laboratory mixing temperature.
- g. Lab compaction temperature.
- h. Temperature-viscosity relationship of the asphalt cement.
- i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.
- j. Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2.
- k. Specific gravity and absorption of each aggregate.
- l. Percent natural sand.
- m. Percent particles with 2 or more fractured faces (in coarse aggregate).
- n. Fine aggregate angularity.
- o. Percent flat or elongated particles (in coarse aggregate).
- p. Tensile Strength Ratio(TSR).
- q. Antistrip agent (if required) and amount.
- r. List of all modifiers and amount.

Table 3. Marshall Design Criteria

<u>Test Property</u>	<u>75 Blow Mix</u>
Stability, pounds minimum	*1800
Flow, 0.01 inch	8-16
Air voids, percent	3-5
Percent Voids in mineral aggregate VMA,	

Table 3. Marshall Design Criteria

<u>Test Property</u> (minimum)	<u>75 Blow Mix</u> 14
TSR, minimum percent	75

* This is a minimum requirement. The average during construction shall be significantly higher than this number to ensure compliance with the specifications.

** Calculate VMA in accordance with AI MS-2, based on ASTM D 2726 bulk specific gravity for the aggregate.

2.3.2 Adjustments to Field JMF

The Laboratory JMF for each mixture shall be in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, a new laboratory jmf design shall be performed and a new JMF approved before the new material is used. The Contractor will be allowed to adjust the Laboratory JMF within the limits specified below to optimize mix volumetric properties with the approval of the Contracting Officer. Adjustments to the Laboratory JMF shall be applied to the field (plant) established JMF and limited to those values as shown. Adjustments shall be targeted to produce or nearly produce 4 percent voids total mix (VTM).

TABLE 4. Field (Plant) Established JMF Tolerances
Sieves Adjustments (plus or minus), percent

No. 4	3
No. 8	3
No. 200	1
Binder Content	0.40

If adjustments are needed that exceed these limits, a new mix design shall be developed. Tolerances given above may permit the aggregate grading to be outside the limits shown in Table 2; while not desirable, this is acceptable.

PART 3 EXECUTION

3.1 PREPARATION OF ASPHALT BINDER MATERIAL

The asphalt cement material shall be heated avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of unmodified asphalts shall be no more than 325 degrees F when added to the aggregates. Modified asphalts shall be no more than 350 degrees F when added to the aggregates.

3.2 PREPARATION OF MINERAL AGGREGATE

The aggregate for the mixture shall be heated and dried prior to mixing. No damage shall occur to the aggregates due to the maximum temperature and rate of heating used. The temperature of the aggregate and mineral filler shall not exceed 350 degrees F when the asphalt cement is added. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.3 PREPARATION OF HOT-MIX ASPHALT MIXTURE

The aggregates and the asphalt cement shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but no less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used.

The wet mixing time will be set to at least achieve 95 percent of coated particles. The moisture content of all hot-mix asphalt upon discharge from the plant shall not exceed 0.5 percent by total weight of mixture as measured by ASTM D 1461.

3.4 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing the hot mix asphalt, the underlying course shall be cleaned of dust and debris. A prime coat and tack coat shall be applied in accordance with the contract specifications.

3.5 TEST SECTION

Prior to full production, the Contractor shall place a test section for each JMF used. The contractor shall construct a test section 250 - 500 feet long and two paver passes wide placed for two lanes, with a longitudinal cold joint. The test section shall be of the same depth as the course which it represents. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test section. The equipment and personnel used in construction of the test section shall be the same equipment to be used on the remainder of the course represented by the test section. The test section shall be placed as part of the project pavement as approved by the Contracting Officer.

3.5.1 Sampling and Testing for Test Section

One random sample shall be taken at the plant, triplicate specimens compacted, and tested for stability, flow, and laboratory air voids. A portion of the same sample shall be tested for aggregate gradation and asphalt content. Four randomly selected cores shall be taken from the finished pavement mat, and four from the longitudinal joint, and tested for density. Random sampling shall be in accordance with procedures contained in ASTM D 3665. The test results shall be within the tolerances shown in Table 5 for work to continue. If all test results meet the specified requirements, the test section shall remain as part of the project pavement. If test results exceed the tolerances shown, the test section shall be removed and replaced at no cost to the Government and another test section shall be constructed. The test section shall be paid for with the first lot of paving

Table 5. Test Section Requirements for Material and Mixture Properties

<u>Property</u>	<u>Specification Limit</u>
Asphalt Content, Percent (Individual Test Result)	JMF plus or minus 0.5

Table 5. Test Section Requirements for Material and Mixture Properties

<u>Property</u>	<u>Specification Limit</u>
Laboratory Air Voids, Percent (Average of 3 specimens)	JMF plus or minus 1.0
VMA, Percent (Average of 3 specimens)	14 minimum
Stability, pounds (Average of 3 specimens)	1800 minimum
Flow, 0.01 inches (Average of 3 specimens)	8 - 16
Mat Density, Percent of Marshall (Average of 4 Random Cores)	97.0 - 100.5
Joint Density, Percent of Marshall (Average of 4 Random Cores)	95.5 - 100.5

3.5.2 Additional Test Sections

If the initial test section should prove to be unacceptable, the necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures shall be made. A second test section shall then be placed. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Full production shall not begin until an acceptable section has been constructed and accepted.

3.6 TESTING LABORATORY

The laboratory used to develop the JMF shall meet the requirements of ASTM D 3666. A certification signed by the manager of the laboratory stating that it meets these requirements or clearly listing all deficiencies shall be submitted to the Contracting Officer prior to the start of construction. The certification shall contain as a minimum:

- a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.
- b. A listing of equipment to be used in developing the job mix.
- c. A copy of the laboratory's quality control system.
- d. Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program.

3.7 TRANSPORTING AND PLACING

3.7.1 Transporting

The hot-mix asphalt shall be transported from the mixing plant to the site in clean, tight vehicles. Deliveries shall be scheduled so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Adequate artificial lighting shall be provided for night placements. Hauling over freshly placed material will not be permitted until the material has been compacted as specified, and allowed to cool to 140 degrees F.

3.7.2 Placing

The mix shall be placed and compacted at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Upon arrival, the mixture shall be placed to the full width by an asphalt paver; it shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface course shall be at the centerline of the pavement. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools.

3.8 COMPACTION OF MIXTURE

After placing, the mixture shall be thoroughly and uniformly compacted by rolling. The surface shall be compacted as soon as possible without causing displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once. Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened but excessive water will not be permitted.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand tampers. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective shall be removed full depth, replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching will not be allowed.

3.9 JOINTS

The formation of joints shall be made ensuring a continuous bond between the courses and to obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.9.1 Transverse Joints

The roller shall not pass over the unprotected end of the freshly laid mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing material at the joint. The cutback material shall be removed from

the project. In both methods, all contact surfaces shall be given a light tack coat of asphalt material before placing any fresh mixture against the joint.

3.9.2 Longitudinal Joints

Longitudinal joints which are irregular, damaged, uncompacted, cold (less than 175 degrees F at the time of placing adjacent lanes), or otherwise defective, shall be cut back a minimum of 2 inches from the edge with a cutting wheel to expose a clean, sound vertical surface for the full depth of the course. All cutback material shall be removed from the project. All contact surfaces shall be given a light tack coat of asphalt material prior to placing any fresh mixture against the joint. The Contractor will be allowed to use an alternate method if it can be demonstrated that density, smoothness, and texture can be met.

3.10 CONTRACTOR QUALITY CONTROL

3.10.1 General Quality Control Requirements

The Contractor shall develop an approved Quality Control Plan. Hot-mix asphalt for payment shall not be produced until the quality control plan has been approved. The plan shall address all elements which affect the quality of the pavement including, but not limited to:

- a. Mix Design
- b. Aggregate Grading
- c. Quality of Materials
- d. Stockpile Management
- e. Proportioning
- f. Mixing and Transportation
- g. Mixture Volumetrics
- h. Moisture Content of Mixtures
- i. Placing and Finishing
- j. Joints
- k. Compaction
- l. Surface Smoothness

3.10.2 Testing Laboratory

The Contractor shall provide a fully equipped asphalt laboratory located at the plant or job site. The laboratory shall meet the requirements as required in ASTM D 3666. The effective working area of the laboratory shall be a minimum of 150 square feet with a ceiling height of not less than 7.5 feet. Lighting shall be adequate to illuminate all working areas. It shall be equipped with heating and air conditioning units to maintain a temperature of 75 degrees F plus or minus 5 degrees F. Laboratory facilities shall be kept clean and all equipment shall be

maintained in proper working condition. The Contracting Officer shall be permitted unrestricted access to inspect the Contractor's laboratory facility, to witness quality control activities, and to perform any check testing desired. The Contracting Officer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to adversely affect test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are corrected.

3.10.3 Quality Control Testing

The Contractor shall perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The testing program shall include, but shall not be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, stability, flow, in-place density, grade and smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

3.10.3.1 Asphalt Content

A minimum of two tests to determine asphalt content will be performed per lot (a lot is defined in paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT) by one of the following methods: the extraction method in accordance with ASTM D 2172, Method A or B, the ignition method in accordance with the AASHTO TP53 or ASTM D 6307, or the nuclear method in accordance with ASTM D 4125, provided the nuclear gauge is calibrated for the specific mix being used. For the extraction method, the weight of ash, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.

3.10.3.2 Gradation

Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of recovered aggregate in accordance with ASTM D 5444. When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix plants. For batch plants, aggregates shall be tested in accordance with ASTM C 136 using actual batch weights to determine the combined aggregate gradation of the mixture.

3.10.3.3 Temperatures

Temperatures shall be checked at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt cement in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

3.10.3.4 Aggregate Moisture

The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.

3.10.3.5 Moisture Content of Mixture

The moisture content of the mixture shall be determined at least once per lot in accordance with ASTM D 1461 or an approved alternate procedure.

3.10.3.6 Laboratory Air Voids, Marshall Stability and Flow

Mixture samples shall be taken at least four times per lot and compacted into specimens, using 75 blows per side with the Marshall hammer as described in ASTM D 1559. After compaction, the laboratory air voids of each specimen shall be determined, as well as the Marshall stability and flow.

3.10.3.7 In-Place Density

The Contractor shall conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge may be used to monitor pavement density in accordance with ASTM D 2950.

3.10.3.8 Grade and Smoothness

The Contractor shall conduct the necessary checks to ensure the grade and smoothness requirements are met in accordance with paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT.

3.10.3.9 Additional Testing

Any additional testing, which the Contractor deems necessary to control the process, may be performed at the Contractor's option.

3.10.3.10 QC Monitoring

The Contractor shall submit all QC test results to the Contracting Officer on a daily basis as the tests are performed. The Contracting Officer reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.10.4 Sampling

When directed by the Contracting Officer, the Contractor shall sample and test any material which appears inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

3.10.5 Control Charts

For process control, the Contractor shall establish and maintain linear control charts on both individual samples and the running average of the last four samples for the parameters listed in Table 6, as a minimum. These control charts shall be posted as directed by the Contracting Officer and shall be kept current at all times. The control charts shall identify the project number, the test parameter being plotted, the individual sample numbers, the Action and Suspension Limits listed in Table 6 applicable to the test parameter being plotted, and the Contractor's test results. Target values from the JMF shall also be shown on the control charts as indicators of central tendency for the cumulative percent passing, asphalt content, and laboratory air voids parameters. When the test results exceed either applicable Action Limit, the Contractor shall take immediate steps to bring the process back in control. When the test results exceed either

applicable Suspension Limit, the Contractor shall halt production until the problem is solved. The Contractor shall use the control charts as part of the process control system for identifying trends so that potential problems can be corrected before they occur. Decisions concerning mix modifications shall be made based on analysis of the results provided in the control charts. The Quality Control Plan shall indicate the appropriate action which shall be taken to bring the process into control when certain parameters exceed their Action Limits.

Table 6. Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

Parameter to be Plotted	Running Average of <u>Individual Samples</u>		<u>Last Four Samples</u>	
	Action Limit	Suspension Limit	Action Limit	Suspension Limit
Stability, pounds (minimum)				
75 Blow JMF	1800	1700	1900	1800
Flow, 0.01 inches				
75 Blow	8 min. 16 max.	7 min. 17 max.	9 min. 15 max.	8 min. 16 max.
Asphalt content, % deviation from JMF target; plus or minus value	0.4	0.5	0.2	0.3
Laboratory Air Voids, % deviation from JMF target value	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Mat Density, % of Marshall density	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Joint Density, % of Marshall density	No specific action and suspension limits set since this parameter is used to determine percent payment			

3.11 MATERIAL ACCEPTANCE

Testing for acceptability of work will be performed by an independent laboratory hired by the Contractor. Test results and payment calculations shall be forwarded daily to the Contracting Officer. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis.

A standard lot for all requirements will be equal to 8 hours of production and a minimum of 750 tons. Where appropriate, adjustment in payment for individual lots of hot-mix asphalt will be made based on in-place density, laboratory air voids, grade and smoothness in accordance with the following paragraphs. Grade and surface smoothness determinations will be made on the lot as a whole. Exceptions or adjustments to this will be made in situations where the mix within one lot is placed as part of both the intermediate and surface courses, thus grade and smoothness measurements for the entire lot cannot be made. In order to evaluate laboratory air voids and in-place (field) density, each lot will be divided into four equal sublots.

3.11.1 Acceptance

When a lot of material fails to meet the specification requirements, that lot shall be removed and replaced.

3.11.2 Sublot Sampling

One random mixture sample for determining laboratory air voids, theoretical maximum density, and for any additional testing the Contracting Officer desires, will be taken from a loaded truck delivering mixture to each sublot, or other appropriate location for each sublot. All samples will be selected randomly, using commonly recognized methods of assuring randomness conforming to ASTM D 3665 and employing tables of random numbers or computer programs. Laboratory air voids will be determined from three laboratory compacted specimens of each sublot sample in accordance with ASTM D 1559. The specimens will be compacted within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Samples will not be reheated prior to compaction and insulated containers will be used as necessary to maintain the temperature.

3.11.3 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Government. Testing in these areas will be in addition to the lot testing, and the requirements for these areas will be the same as those for a lot.

3.11.4 Laboratory Air Voids

Laboratory air voids will be calculated by determining the Marshall density of each lab compacted specimen using ASTM D 2726 and determining the theoretical maximum density of every other sublot sample using ASTM D 2041.

Laboratory air void calculations for each sublot will use the latest theoretical maximum density values obtained, either for that sublot or the previous sublot. The mean absolute deviation of the four laboratory air void contents (one from each sublot) from the JMF air void content will be evaluated. All laboratory air void tests will be completed and reported within 24 hours after completion of construction of each lot.

3.11.5 Mean Absolute Deviation

An example of the computation of mean absolute deviation for laboratory air voids is as follows: Assume that the laboratory air voids are determined from 4 random samples of a lot (where 3 specimens were compacted from each sample). The average laboratory air voids for each sublot sample are determined to be 3.5, 3.0, 4.0, and 3.7. Assume that the target air voids from the JMF is 4.0. The mean absolute deviation is then:

$$\text{Mean Absolute Deviation} = (|3.5 - 4.0| + |3.0 - 4.0| + |4.0 - 4.0| + |3.7 - 4.0|)/4$$

$$= (0.5 + 1.0 + 0.0 + 0.3)/4 = (1.8)/4 = 0.45$$

The mean absolute deviation for laboratory air voids is determined to be 0.45.

3.11.6 In-place Density

3.11.6.1 General Density Requirements

For determining in-place density, one random core will be taken by the Government from the mat (interior of the lane) of each subplot, and one random core will be taken from the joint (immediately over joint) of each subplot. Each random core will be full thickness of the layer being placed.

After air drying to a constant weight, cores obtained from the mat and from the joints will be used for in-place density determination.

3.11.6.2 Mat and Joint Densities

The average in-place mat and joint densities are expressed as a percentage of the average Marshall density for the lot. The Marshall density for each lot will be determined as the average Marshall density of the four random samples (3 specimens compacted per sample). The average in-place mat density and joint density for a lot are determined and compared with Table 8 to determine acceptance per lot based on in-place density, as described below. The area associated with the joint is then determined and will be considered to be 10 feet wide times the length of completed longitudinal construction joint in the lot. This area will not exceed the total lot size. The length of joint to be considered will be that length where a new lane has been placed against an adjacent lane of hot-mix asphalt pavement, either an adjacent freshly paved lane or one paved at any time previously. All density results for a lot will be completed and reported within 24 hours after the construction of that lot.

Table 7. Acceptance Based on In-place Lot Density	
Average Mat Density (4 Cores)	Average Joint Density (4 Cores)
-----	-----
97.9 or above	96.4 or above

3.11.6.3 [Enter Appropriate Subpart Title Here]

3.11.7 Grade

The final wearing surface of pavement shall conform to the elevations and cross sections shown and shall vary not more than 0.05 foot from the plan grade established and approved at site of work. Finished surfaces at juncture with other pavements shall coincide with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The final wearing surface of the pavement will be tested for conformance with specified plan grade requirements. The grade will be determined by running lines of levels at intervals of 25 feet, or less, longitudinally and transversely, to determine the elevation of the completed pavement surface. Within 5 working days, after the completion of a particular lot incorporating the final wearing surface, the Contracting Officer will inform the Contractor in writing, of the results of the grade-conformance tests. In areas where the grade exceeds the tolerance by more than 50 percent, the Contractor shall remove the surface lift full depth; the Contractor shall then replace the lift with hot-mix asphalt to meet specification requirements, at no additional cost to the Government. Diamond grinding may be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted.

3.11.8 Surface Smoothness

The Contractor shall use the following method to test and evaluate surface smoothness of the pavement. All testing shall be performed in the presence of the Contracting Officer. Detailed notes of the results of the testing shall be kept and a copy furnished to the Government immediately after each day's testing. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer.

3.11.8.1 Smoothness Requirements

a. **Straightedge Testing:** The finished surfaces of the pavements shall have no abrupt change of 1/4 inch or more, and all pavements shall be within the tolerances specified in Table 9 when checked with an approved 12 foot straightedge.

<u>Table 9. Straightedge Surface Smoothness--Pavements</u>		
<u>Pavement Category</u>	<u>Direction of Testing</u>	<u>Tolerance, inches</u>
-----	-----	-----
All	Longitudinal	1/4
paved areas	Transverse	1/4

3.11.8.2 Testing Method

After the final rolling, but not later than 24 hours after placement, the surface of the pavement in each entire lot shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. Separate testing of individual sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 25 feet or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane for lines less than 20 feet and at the third points for lanes 20 feet or greater. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints.

a. **Straightedge Testing.** The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points.

3.11.8.3 Surface Deviation

Any small individual area with surface deviation which exceeds the tolerance given above by more than 50 percent, shall be corrected by diamond grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government. All areas which collect and retain water shall be corrected. The Contracting Officer will determine the method by which the surface deviation is corrected.

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SECTION 02748A

BITUMINOUS TACK AND PRIME COATS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 140	(200) Sampling Bituminous Materials
ASTM D 977	(1998) Emulsified Asphalt
ASTM D 1250	(1980; R 1997e1) Petroleum Measurement Tables
ASTM D 2397	(1998) Cationic Emulsified Asphalt
ASTM D 2995	(1999) Determining Application Rate of Bituminous Distributors

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Waybills and Delivery Tickets

Waybills and delivery tickets, during progress of the work.

SD-06 Test Reports

Sampling and Testing

Copies of all test results for bituminous materials, within 24 hours of completion of tests. Certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements, not less than 30 days before the material is required in the work.

1.3 PLANT, EQUIPMENT, MACHINES AND TOOLS

1.3.1 General Requirements

Plant, equipment, machines and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times.

1.3.2 Bituminous Distributor

The distributor shall have pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the base surface or other layers in the pavement structure. The distributor shall be designed and equipped to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

1.3.3 Power Brooms and Power Blowers

Power brooms and power blowers shall be suitable for cleaning the surfaces to which the bituminous coat is to be applied.

1.4 WEATHER LIMITATIONS

Bituminous coat shall be applied only when the surface to receive the bituminous coat is dry. Bituminous coat shall be applied only when the atmospheric temperature in the shade is 50 degrees F or above and when the temperature has not been below 35 degrees F for the 12 hours prior to application.

PART 2 PRODUCTS

2.1 TACK COAT

Emulsified asphalt shall conform to ASTM D 977 Grade SS-1. Cationic emulsified asphalt shall conform to ASTM D 2397 Grade CSS-1.

2.2 PRIME COAT

Emulsified asphalt shall conform to ASTM D 977 or , Grade SS-1. Cationic emulsified asphalt shall conform to ASTM D 2397 Grade CSS-1.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACE

Immediately before applying the bituminous coat, all loose material, dirt, clay, or other objectionable material shall be removed from the surface to be treated. The surface shall be dry and clean at the time of treatment.

3.2 APPLICATION RATE

The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer.

3.2.1 Tack Coat

Bituminous material for the tack coat shall be applied in quantities of not less than 0.05 gallon nor more than 0.15 gallon per square yard of pavement surface.

3.2.2 Prime Coat

Bituminous material for the prime coat shall be applied in quantities of not less than 0.15 gallon nor more than 0.40 gallon per square yard of pavement surface.

3.3 APPLICATION TEMPERATURE

3.3.1 Viscosity Relationship

Asphalt application temperature shall provide an application viscosity between 10 and 60 seconds, Saybolt Furol, or between 20 and 120 centistokes, kinematic. The temperature viscosity relation shall be furnished to the Contracting Officer.

3.3.2 Temperature Ranges

The viscosity requirements shall determine the application temperature to be used. The following is a normal range of application temperatures:

Emulsions	

SS-1	70-160 degrees F
CSS-1	70-160 degrees F

3.4 APPLICATION

3.4.1 General

Following preparation and subsequent inspection of the surface, the bituminous coat shall be applied at the specified rate with uniform distribution over the surface to be treated. All areas and spots missed by the distributor shall be properly treated with the hand spray. Until the succeeding layer of pavement is placed, the surface shall be maintained by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, clean dry sand shall be spread to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the equipment shall be permitted within 25 feet of heating, distributing, and transferring operations of bituminous material other than bituminous emulsions. All traffic, except for paving equipment used in constructing the surfacing, shall be prevented from using the underlying material, whether primed or not, until the surfacing is completed. The bituminous coat shall conform to all requirements as described herein.

3.5 CURING PERIOD

Following application of the bituminous material and prior to application of the succeeding layer of pavement, the bituminous coat shall be allowed to cure and to obtain evaporation of any volatiles or moisture. Prime coat shall be allowed to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course.

3.6 FIELD QUALITY CONTROL

Samples of the bituminous material used shall be obtained by the Contractor as directed, under the supervision of the Contracting Officer. The sample may be retained and tested by the Government at no cost to the Contractor.

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SECTION 02754A

CONCRETE PAVEMENTS FOR SMALL PROJECTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 301	(1999) Standard Specifications for Structural Concrete
ACI 305R	(1999) Hot Weather Concreting

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 184/A 184M	(1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 615/A 615M	(2000) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 31/C 31M	(2000) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1999a) Concrete Aggregates
ASTM C 39/C 39M	(1999) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94/C 94M	(2000) Ready-Mixed Concrete
ASTM C 123	(1998) Lightweight Particles in Aggregate
ASTM C 143/C 143M	(2000) Slump of Hydraulic Cement Concrete
ASTM C 150	(1999a) Portland Cement
ASTM C 192/C 192M	(2000) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2000) Air-Entraining Admixtures for

Concrete

ASTM C 494/C 494M	(1999a) Chemical Admixtures for Concrete
ASTM C 618	(2000) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 1752	(1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 130	(1989) Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1996) Concrete Plant Standards
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1.2 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of concrete (rigid) pavement. However, where the construction covered herein interfaces with other sections, the construction at each interface shall conform to the requirements of both this section and the other section, including tolerances for both.

1.3 ACCEPTABILITY OF WORK

The pavement will be accepted on the basis of tests made by the Government and by the Contractor or its suppliers, as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing. Concrete samples shall be taken by the Contractor at the placement to determine the slump, air content, and strength of the concrete. Test cylinders shall be made for determining conformance with the strength requirements of these specifications and, when required, for determining the time at which pavements may be placed into service. All air content measurements shall be determined in accordance with ASTM C 231. All slump tests shall be made in accordance with ASTM C 143/C 143M. All test cylinders shall be 6 by 12 inch cylinders and shall be fabricated in accordance with ASTM C 192/C 192M, using only steel molds, cured in accordance with ASTM C 31/C 31M, and tested in accordance with ASTM C 39/C 39M. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and

protecting test specimens at the site and in the laboratory.

1.3.1 Evaluation Sampling

Sampling, testing, and mixture proportioning shall be performed by a commercial Testing Laboratory, conforming with ASTM C 1077. The individuals who sample and test concrete and concrete constituents shall be certified as American Concrete Institute (ACI) Concrete Field Testing Technicians, Grade I. The individuals who perform the inspection of concrete shall be certified as ACI Concrete Construction Inspector, Level II. All mix design, weekly quality control reports, smoothness reports, and project certification reports shall be signed by a Registered Engineer.

1.3.2 Surface Testing

Surface testing for surface smoothness, edge slump and plan grade shall be performed as indicated below by the Testing Laboratory. The measurements shall be properly referenced in accordance with paving lane identification and stationing, and a report given to the Government within 24 hours after measurement is made. A final report of surface testing, signed by a Registered Engineer, containing all surface measurements and a description of all actions taken to correct deficiencies, shall be provided to the Government upon conclusion of surface testing.

1.3.2.1 Surface Smoothness Requirements

The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and all pavements shall be within the tolerances specified in Table 1 when checked with the straightedge.

TABLE 1
STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category -----	Direction of Testing -----	Tolerances inches -----
Roads and Streets	Longitudinal	3/16
	Transverse	1/4
Hardstands, Parking Areas, Open Storage Areas	Longitudinal	1/4
	Transverse	1/4

1.3.2.2 Surface Smoothness Testing Method

The surface of the pavement shall be tested with the straightedge to identify all surface irregularities exceeding the tolerances specified above. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines approximately 15 feet apart. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points.

1.3.3 Edge Slump Testing and Conformance

When slip-form paving is used, not more than 15 percent of the total free

edge of the slipformed portion of the pavement, shall have an edge slump exceeding 1/4 inch and no slab shall have an edge slump exceeding 3/8 inch. Edge slump shall be determined as above for surface smoothness, at each free edge of each slipformed paving lane constructed. Measurements shall be made at 5 to 15 foot spacings, and as directed. When edge slump exceeding the limits specified above is encountered on either side of the paving lane, additional straightedge measurements shall be made, if required, to define the linear limits of the excessive slump. The concrete for the entire width of the paving lane within these limits of excessive edge slump shall be removed and replaced. Adding concrete or paste to the edge or otherwise manipulating the plastic concrete after the sliding form has passed, or patching the hardened concrete, shall not be used as a method for correcting excessive edge slump.

1.3.4 Plan Grade Testing and Conformance

The finished surface of the pavements shall conform, within the tolerances shown in Table 1, to the lines, grades, and cross sections shown. The finished surface of new abutting pavements shall coincide at their juncture. The surface of the pavement shall vary not more than 0.06 foot above or below the plan grade line or elevation indicated. Each pavement category shall be checked by the Contractor for conformance with plan grade requirements by running lines of levels at intervals to determine the elevation at each joint intersection.

1.4 PRECONSTRUCTION TESTING OF MATERIALS

The Contractor shall not be entitled to any additional payment or extension of time because of delays caused by sampling and testing additional sources, or samples, necessitated by failure of any samples. Aggregates shall be sampled and tested by the Test Laboratory and shall be representative of the materials to be used for the project. Test results, signed by a Registered Engineer, shall be submitted 45 days before commencing paving. No aggregate shall be used unless test results show that it meets all requirements of these specifications, including compliance with ASTM C 33 and deleterious materials limitations.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment; G

Manufacturer's literature on the concrete plant; mixing equipment; hauling equipment; placing and finishing, and curing equipment; at least 45 days prior to start of paving.

Paving; G

Paving Schedules at least 14 days prior to start of paving.

Mixture Proportions; G

The report of the Contractor's mixture proportioning studies showing the proportions of all ingredients and supporting information on aggregate and other materials that will be used in the manufacture of concrete, at least 45 days prior to commencing concrete placing operations.

1.6 EQUIPMENT

1.6.1 Batching and Mixing

The batching plant shall conform to NRMCA CPMB 100, the equipment requirements in ASTM C 94/C 94M, and as specified. Water shall not be weighed or measured cumulatively with another ingredient. All concrete materials batching shall meet ASTM C 94/C 94M requirements. Mixers shall be stationary mixers or truck mixers. Batching, mixers, mixing time, permitted reduction of mixing time, and concrete uniformity shall meet the requirements of ASTM C 94/C 94M, and shall be documented in the initial weekly QC Report.

1.6.2 Transporting Equipment

Transporting equipment shall be in conformance with ASTM C 94/C 94M and as specified herein. Concrete shall be transported to the paving site in rear-dump trucks, in truck mixers designed with extra large blading and rear opening specifically for low slump concrete, or in agitators. Bottom-dump trucks shall not be used for delivery of concrete.

1.6.3 Delivery Equipment

When concrete transport equipment cannot operate on the paving lane, side-delivery transport equipment consisting of self-propelled moving conveyors shall be used to deliver concrete from the transport equipment and discharge it in front of the paver. Front-end loaders, dozers, or similar equipment shall not be used to distribute the concrete.

1.6.4 Paver-Finisher

The paver-finisher shall be a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement. The paver-finisher shall spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The paver-finisher shall be equipped with a full width "knock-down" auger, capable of operating in both directions, which will evenly spread the fresh concrete in front of the screed or extrusion plate. Immersion vibrators shall be gang mounted at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete. The vibrators shall be automatically controlled so that they will be immediately stopped as forward motion of the paver ceases. The spacing of the immersion vibrators across the paving lane shall be as necessary to properly consolidate the concrete, but the clear distance between vibrators shall not exceed 30 inches, and the outside vibrators shall not exceed 12 inches from the edge of the lane. The paver-finisher shall be equipped with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface.

1.6.4.1 Paver-Finisher with Fixed Forms

The paver-finisher shall be equipped with wheels designed to ride the

forms, keep it aligned with the forms, and to spread the preventing deformation of the forms.

1.6.4.2 Slipform Paver-Finisher

If a slipform paver-finisher is used, it shall be automatically controlled and crawler mounted with padded tracks. Horizontal alignment shall be electronically referenced to a taut wire guideline. Vertical alignment shall be electronically referenced on both sides of the paver to a taut wire guideline, to an approved laser control system, or to a ski operating on a completed lane. Control from a slope-adjustment control or control operating from the underlying material shall not be used.

1.6.4.3 Other Types of Finishing Equipment

Bridge deck finishers shall be used for pavements 10 inches or less in thickness, where longitudinal and transverse surface smoothness tolerances are 1/4 inch or greater. Clary screeds or other rotating tube floats will not be allowed on the project.

1.6.5 Curing Equipment

Equipment for curing is specified in paragraph CURING.

1.6.6 Texturing Equipment

Texturing equipment shall be as specified below.

1.6.6.1 Fabric Drag

A fabric drag shall consist of a piece of fabric material as wide as the lane width securely attached to a separate wheel mounted frame spanning the paving lane or to one of the other similar pieces of equipment. The material shall be wide enough to provide 12 to 18 inches dragging flat on the pavement surface. The fabric material shall be clean, reasonably new burlap, kept clean and saturated during use.

1.6.7 Sawing Equipment

Equipment for sawing joints and for other similar sawing of concrete shall be standard diamond-tip-bladed concrete saws mounted on a wheeled chassis.

1.6.8 Straightedge

The Contractor shall furnish and maintain at the job site one 12 foot straightedge for testing concrete surface smoothness. The straightedge shall be constructed of aluminum or magnesium alloy and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles for operation on the pavement.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious materials shall be portland cement in combination with pozzolan and shall conform to appropriate specifications listed below.

2.1.1 Portland Cement

Portland cement shall conform to ASTM C 150 Type II, low-alkali including false set requirements.

2.1.2 Pozzolan (Fly Ash)

Fly ash shall conform to ASTM C 618 Class F, including all the supplementary optional physical requirements. Fly ash shall be used at a rate between 15 and 35 percent of the total cementitious material by mass. Loss on ignition shall not exceed 6 percent.

2.2 AGGREGATES

Aggregates shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33, including deleterious materials, abrasion loss and soundness requirements of ASTM C 33, and other requirements specified herein.

2.2.1 Coarse Aggregate

Coarse aggregate shall consist of crushed or uncrushed gravel, crushed stone, or a combination thereof. Crushed gravel shall contain not less than 75 percent of crushed particles by mass in each sieve size, as determined by COE CRD-C 171.

2.2.1.1 Quality

Aggregates as delivered to the mixers shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33 and other requirements specified herein. In addition to what was specified in ASTM C 33, the aggregate shall have a degradation value of no greater than 40 when tested after 500 revolutions in accordance to ASTM C 131. Coarse aggregate shall be washed. Washing shall be sufficient to remove dust and other coatings.

2.2.1.2 Particle Shape Characteristics

Particles of the coarse aggregate shall be generally spherical or cubical in shape. The quantity of flat and elongated particles in any size group shall not exceed 20 percent by weight as determined by COE CRD-C 119. A flat particle is defined as one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3.

2.2.1.3 Size and Grading

The nominal maximum size of the coarse aggregate shall be 1-1/2 inches. The aggregates shall be furnished in two size groups as follows:

<u>Nominal Maximum Size</u> <u>Inches</u>	<u>Size Group</u>
3/4	ASTM C 33 --No.67 (No. 4 to 3/4 inch)
1-1/2	ASTM C 33 --No. 4 (3/4 to 1-1/2 inch)

The grading of the coarse aggregate within the separated size groups shall conform to the requirements of ASTM C 33, Sizes 67 and 4 as delivered to the mixer. The ratio of sand to total aggregate weight shall be between 38 and 42 percent.

2.2.1.4 Deleterious Substances

The total of all deleterious substances shall not exceed 3.0 percent by weight of the coarse aggregate. The percentage of material finer than No. 200 sieve shall not be included in this total. The limit for material finer than No. 200 sieve will be increased to 1.5 percent for crushed aggregates consisting of crusher dust that is essentially free from clay or shale. The amount of deleterious substances in each size group of coarse aggregate shall not exceed the limits shown below.

TABLE 5
LIMITS OF DELETERIOUS SUBSTANCES FOR COARSE AGGREGATE

<u>Materials</u>	<u>Percentage by Weight</u>
Clay lumps and friable particles (ASTM C 142)	2.0
Material finer than 0.075 mm (No. 200 sieve) (a) (ASTM C 117)	1.0
Lightweight particles (b) (ASTM C 123)	1.0
Other soft particles COE CRD-C 130	2.0

- a. Limit for material finer than 0.075 mm (No. 200 sieve) will be increased to 1.5 percent for crushed aggregates if the fine material consists of crusher dust that is essentially free from clay or shale.
- b. The separation medium shall have a density of 2.0 Mg/cubic meter (Sp. Gr. of 2.0).

2.2.1.5 Testing for Deleterious Material

Samples shall be taken and tested by and at the expense of the Contractor, using appropriate Corps of Engineers (CRD) and ASTM test methods for each 5000 tons of aggregate. Additional tests and analyses of aggregates at various stages in the processing and handling operations may be made by the Government at the discretion of the Contracting Officer. Such Government testing will not relieve the Contractor of any of its testing responsibilities.

2.2.2 Fine Aggregate

2.2.1.6 Composition

Fine aggregate shall consist of natural sand, manufactured sand, or a combination of the two, and shall be composed of clean, hard, durable particles. Irrespective of the source from which it is obtained, all fine aggregate shall be composed of clean, hard, durable particles meeting the

requirements of ASTM C 33. Each type of fine aggregate shall be stockpiled and batched separately. Any degree of contamination will be cause for the rejection of the entire stockpile.

2.2.1.7 Particle Shape

Particles of the fine aggregate shall be generally spherical or cubical in shape.

2.2.1.8 Grading

Grading of the fine aggregate, as delivered to the mixer, shall conform to the requirements of ASTM C 33. In addition, the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.50 nor more than 3.00. The grading of the fine aggregate also shall be controlled so that the fineness moduli of at least nine of every set of ten consecutive samples of the fine aggregate, as delivered to the mixer, will not vary more than 0.15 from the average fineness moduli of all samples previously taken. The fineness modulus shall be determined by COE CRD-C 104.

2.2.1.9 Deleterious Material

The amount of deleterious material in the fine aggregate shall not exceed the following limits:

<u>Material</u>	<u>Percentage by Mass</u>
Clay lumps and friable particles (ASTM C 142)	1.0
Lightweight particles (ASTM C 123 using a medium with a density of 2.0 Mg/cubic meter (Sp. Gr. of 2.0))	0.5

2.2.1.10 Testing for Deleterious Material

Samples shall be taken and tested by and at the expense of the Contractor, using appropriate Corps of Engineers (CRD) laboratory and ASTM test methods for each 200 tons of aggregate. Additional tests and analyses of aggregates at various stages in the processing and handling operations may be made by the Government at the discretion of the Contracting Officer. Such Government testing will not relieve the Contractor of any of its testing responsibilities.

2.2.1.11 Resistance to Freezing and Thawing

Coarse aggregate not having a satisfactory demonstrable service record shall have a durability factor of 50 or more when subjected to freezing and thawing in concrete in accordance with COE CRD-C 114.

2.2.1.12 Resistance to Abrasion

Coarse aggregate shall not show more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131.

2.2.1.13 Deleterious Material-Road Pavements

The amount of deleterious material in each sieve size of coarse aggregate shall not exceed the limits in the following table when tested as indicated.

LIMITS OF DELETERIOUS MATERIALS IN COARSE
AGGREGATE FOR ROAD PAVEMENTS
Percentage by Mass

Clay lumps and friable particles (ASTM C 142)	2.0
Material finer than 0.075 mm (No. 200 sieve) (ASTM C 117)	1.0
Lightweight particles (ASTM C 123)	1.0
Other soft particles (ASTM C 330)	2.0

The total of all deleterious substances shall not exceed 5.0 percent of the mass of the aggregate. The percentage of material finer than the No. 200 sieve shall not be included in this total. The limit for material finer than the No. 200 sieve will be increased to 1.5 percent for crushed aggregates consisting of crusher dust that is essentially free from clay or shale. The separation medium for lightweight particles shall have a density of 2.0 Mg/cubic meter (Sp. Gr. 2.0). This limit does not apply to coarse aggregate manufactured from blast-furnace slag unless contamination is evident.

2.3 CHEMICAL ADMIXTURES

The air-entraining admixture shall conform to ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entraining admixture shall be in a solution of suitable concentration for field use. A water-reducing admixture shall meet the requirements of ASTM C 494, Type A or D except that the 6-month and 1-year compressive strength tests are waived. The admixture may be added to the concrete mixture only when its use is approved or directed, and only when it has been used in mixture proportioning studies to arrive at approved mixture proportions.

2.4 CURING MATERIALS

Membrane forming curing compound shall be a white pigmented compound conforming to COE CRD-C 300. Burlap used for curing shall conform to AASHTO M 182, Class 3 or 4. Materials shall be new or shall be clean materials never used for anything other than curing concrete. Impervious sheet materials shall conform to ASTM C 171, type optional, except polyethylene sheet shall not be used.

2.5 WATER

Water for mixing and curing shall be clean, potable, and free of injurious amounts of oil, acid, salt, or alkali.

2.6 JOINT MATERIALS

2.6.1 Expansion Joint Material

Expansion joint filler shall be a preformed material conforming to ASTM D 1752 Type I, II or III. Expansion joint filler shall be 3/4 inch thick.

2.6.2 Slip Joint Material

Slip joint material shall be 1/4 inch thick expansion joint filler conforming to ASTM D 1752.

2.7 REINFORCING

2.7.1 General

Reinforcing bars shall conform to ASTM A 615/A 615M Grade 60. Bar mats shall conform to ASTM A 184/A 184M. Reinforcement shall be free from loose, flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete.

2.8 DOWELS AND TIE BARS

2.8.1 Dowels

Dowels shall be single piece bars fabricated or cut to length at the shop or mill before delivery to the site. Dowels shall be free of loose, flaky rust and loose scale and shall be clean and straight. Dowels may be sheared to length provided that the deformation from true shape caused by shearing does not exceed 0.04 inch on the diameter of the dowel and does not extend more than 0.04 inch from the end of the dowel. Dowels shall be plain (non-deformed) steel bars conforming to ASTM A 615, Grade 60; as indicated. Paint for dowels shall conform to SSPC, Paint 5; SSPC Paint 25; or Federal Specification TT-P-645.

2.8.2 Tie Bars

Tie Bars shall only be used if partial slab repairs on new pavements are required so as to tie the slabs together. Tie bars shall be deformed steel bars conforming to ASTM A 615, Grade 60, and of the sizes and dimensions indicated. Deformed rail steel bars and high-strength billet or axle steel bars, Grade 60 or higher, shall not be used for bars that are bent and straightened during construction.

2.9 EPOXY RESIN

All epoxy-resin materials shall be two-component materials conforming to ASTM C 881, Class as appropriate for each application temperature to be encountered; except, that in addition, the materials shall meet the following requirements:

- a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.
- b. Material for use as patching for complete filling of spalls, wide cracks, and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.
- c. Material for injecting cracks shall be Type IV, Grade 1.
- d. Material for bonding freshly mixed portland cement concrete, mortar, or freshly mixed epoxy resin concrete to hardened concrete shall be Type V, Grade as approved.

2.10 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

Specified compressive strength, f'_c , for concrete is **4000 psi** at 28 days. Maximum allowable water-cementitious material ratio is 0.45. The water-cementitious material ratio is based on absolute volume equivalency, where the ratio is determined using the weight of cement for a cement only mix, or using the total volume of cement plus pozzolan converted to an equivalent weight of cement by the absolute volume equivalency method described in ACI 211.1. The concrete shall be air-entrained with a total air content of 4 plus or minus 1 percent. The maximum allowable slump of the concrete shall be 2 inches for pavement constructed with fixed forms. For slipformed pavement, the maximum allowable slump shall be 1-1/2 inches.

The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'_c and no individual test result falls below the specified strength f'_c by more than 500 psi. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

2.10.1 Concrete Temperature

The temperature of the concrete as delivered shall conform to the requirements of paragraphs, Hot Weather Paving and Cold Weather Paving. Temperature of concrete shall be determined in accordance with ASTM C 1064.

2.11 MIXTURE PROPORTIONS

2.11.1 Composition Concrete

Composition concrete shall be composed of cementitious material, water, fine and coarse aggregates, and admixtures. Fly ash, if used, shall be used only at a rate between 15 and 35 percent by mass of the total cementitious material. Admixtures shall consist of air entraining admixture and may also include, as approved, water-reducing admixture. If water-reducer is used, it shall be used only at the dosage determined during mixture proportioning studies. High range water-reducing admixtures and admixtures to produce flowable concrete shall not be used. No substitutions shall be made in the materials used in the mixture proportions without additional tests to show that the quality of the concrete is satisfactory.

2.11.2 Concrete Mixture Proportioning Studies

Trial design batches, mixture proportioning studies, and testing shall be the responsibility of the Contractor, and shall be performed by the Test Laboratory and signed by a Registered Engineer. No concrete pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions. All materials used in mixture proportioning studies shall be representative of those proposed for use on the project. If there is a change in materials, additional mixture design studies shall be made using the new materials. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1. At least three different water-cementitious ratios, which will produce a range of strength encompassing that required on the project, shall be used. Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content. Maximum sand content shall be 40 percent of the total aggregate SSD weight. Aggregate quantities shall be based on the mass in a saturated surface dry condition.

2.11.3 Mixture Proportioning Procedure

The Contractor shall perform the following:

- a. Fabricate all beams and cylinders for each mixture from the same batch or blend of batches. Fabricate and cure all beams and cylinders in accordance with ASTM C 192, using 6 x 6 inch beams and 6 x 12 inch cylinders.
- b. Test beams in accordance with ASTM C 78, cylinders in accordance with ASTM C 39.
- c. Fabricate and cure test beams from each mixture for 7, 14, and 28-day flexural tests; 6 beams to be tested per age.
- d. Fabricate and cure test cylinders from each mixture for 7, 14, and 28-day compressive strength tests; 6 cylinders to be tested per age.
- e. Using the average strength for each w/c at each age, plot all results from each of the three mixtures on separate graphs for w/c versus:
 - 7-day flexural strength
 - 14-day flexural strength
 - 28-day flexural strength
 - 7-day compressive strength
 - 14-day compressive strength
 - 28-day compressive strength
- f. From these graphs select a w/c that will produce a mixture giving a 28-day flexural strength equal to the required strength determined in accordance with paragraph "Average Flexural Strength Required for Mixtures".
- g. Using the above selected w/c, select from the graphs the expected 7, 14 and 28-day flexural strengths and the expected 7, 14, and 28-day compressive strengths for the mixture.
- h. From the above expected strengths for the selected mixture determine the following Correlation Ratios:
 - (1) Ratio of the 28-day compressive strength of the selected mixture to the 28-day flexural strength of the mixture (for acceptance).
 - (2) Ratio of the 7-day compressive strength of the selected mixture to the 28-day flexural strength of the mixture (for CQC control).
- i. If there is a change in materials, additional mixture design studies shall be made using the new materials and new Correlation Ratios shall be determined.
- j. No concrete pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions.

2.11.4 Average Strength Required for Mixtures

In order to ensure meeting, during production, the strength requirements specified, the mixture proportions selected shall produce a required average strength, f'_{cr} , exceeding the specified strength, f'_c , in accordance with procedures in Chapter 3 of ACI 301, "Proportioning."

2.11.5 Contractor Quality Control for Average Flexural Strength

The Contractor's day to day production shall be Controlled (CQC) in accordance with the criteria herein, in the following subparagraphs, and in paragraph "TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL (CQC)". This entirely different from the acceptance requirements of paragraph "SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES", and it is mandatory that both sets of requirements must be met. If at any time, the "equivalent average 28-day flexural strength", for any lot, as determined by correlation with results of 7-day compressive strength test specimens, is 69 psi or more below the "required equivalent average 28-day flexural strength", as specified below, the paving operation shall be stopped and the Contractor shall take the necessary steps to improve the mixture proportioning, materials, or the batching or mixing to increase the strength. The paving operations shall not recommence until the Contracting Officer has approved the Contractor's proposed changes in writing.

PART 3 EXECUTION

3.1 PREPARATION FOR PAVING

Before commencing paving, the following shall be performed. Surfaces to receive concrete shall be prepared as specified below. If used, forms shall be in place, cleaned, coated, and adequately supported. Any reinforcing steel needed shall be at the paving site. All transporting and transfer equipment shall be ready for use, clean, and free of hardened concrete and foreign material. Equipment for spreading, consolidating, screeding, finishing, and texturing concrete shall be at the paving site, clean and in proper working order. All equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the paving site, in proper working condition, and in sufficient amount for the entire placement. When hot, windy conditions during paving appear probable, equipment and material shall be at the paving site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.2 CONDITIONING OF UNDERLYING MATERIAL

3.2.1 General

Underlying material, subgrade or base course upon which concrete is to be placed shall be clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. Prior to setting forms or placement of concrete, the underlying material shall be well drained and shall have been satisfactorily graded and uniformly compacted in accordance with the applicable Section of these specifications. The surface of the subgrade or base course shall be tested as to crown, elevation, and density in advance of setting forms or of concrete placement. High areas shall be trimmed to proper elevation. Low areas shall be filled and compacted to a condition similar to that of surrounding grade, or filled with concrete monolithically with the pavement. Where low areas are filled with concrete, the areas shall be marked, as approved, and cores for thickness determinations shall not be drilled in those areas. Any underlying

material disturbed by construction operations shall be reworked and recompacted to specified density immediately in front of the paver. If a slipform paver is permitted and is used, the same underlying material under the paving lane shall be continued beyond the edge of the lane a sufficient distance and shall be thoroughly compacted and true to grade to provide a suitable trackline for the slipform paver and firm support for the edge of the paving lane.

3.2.2 Traffic on Underlying Material

After the underlying material has been prepared for concrete placement, no equipment shall be permitted thereon, except as approved for placing concrete. Subject to specific approval, crossing of the prepared subgrade or base course at specified intervals for construction purposes may be permitted, provided rutting or indentations do not occur; however, if traffic has been allowed to use the prepared subgrade or base course, the surface shall be reworked and reprepared to the satisfaction of the Contracting Officer before concrete is placed.

3.3 WEATHER LIMITATIONS

3.3.1 Placement and Protection During Inclement Weather

The Contractor shall not commence placing operations when heavy rain or other damaging weather conditions appear imminent. At all times when placing concrete, the Contractor shall maintain on-site sufficient waterproof cover and means to rapidly place it over all unhardened concrete or concrete that might be damaged by rain. Placement of concrete shall be suspended whenever rain or other damaging weather commences to damage the surface or texture of the placed unhardened concrete, washes cement out of the concrete, or changes the water content of the surface concrete. All unhardened concrete shall be immediately covered and protected from the rain or other damaging weather. Any pavement damaged by rain or other weather shall be completely removed and replaced at the Contractor's expense as specified in paragraph REPAIR, REMOVAL, REPLACEMENT OF SLABS.

3.3.2 Hot Weather Paving

When the ambient temperature during paving is expected to exceed 90 degrees F, the concrete shall be properly placed and finished in accordance with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064. Cooling of the mixing water or aggregates or placing in the cooler part of the day may be required to obtain an adequate placing temperature. Steel forms and reinforcing shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Transporting and placing equipment shall be cooled or protected if necessary to maintain proper concrete-placing temperature. The finished surfaces of the newly laid pavement shall be kept damp by applying a fog spray (mist) with approved spraying equipment until the pavement is covered by the curing medium. If necessary, wind screens shall be provided to protect the concrete from an evaporation rate in excess of 0.2 lb/square foot per hour, as determined by method shown in Figure 2.1.5 of ACI 305R.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature in Degrees F
Greater than 60	90
40-60	85
Less than 40	80

3.3.3 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, the Contractor shall develop and institute measures to prevent plastic shrinkage cracks from developing. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition to the protective measures specified in the previous paragraph, the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding, or wet covering. When such water treatment is stopped, curing procedures shall be immediately commenced. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.3.4 Cold Weather Paving

Special protection measures, as submitted and approved, and as specified herein, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air at the placing site and the temperature of surfaces to receive concrete shall be not less 40 degrees F. However, placement may begin when both the ambient temperature and the temperature of the underlying material are at least 35 degrees F and rising. When the ambient temperature is less than 50 degrees F, the temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period. Pavement damaged by freezing shall be completely removed and replaced at the Contractor's expense as specified in paragraph REPAIR, REMOVAL, REPLACEMENT OF SLABS.

3.4 CONCRETE PRODUCTION

3.4.1 General Requirements

Concrete shall be deposited in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 90 degrees F, the time shall be reduced to 30 minutes. Every load of concrete delivered to the paving site shall be accompanied by a batch ticket from the operator of the batching plant.

Tickets shall show at least the mass, or volume, of all ingredients in each batch delivered, the water meter and revolution meter reading on truck mixers and the time of day. Tickets shall be delivered to the placing foreman who shall keep them on file and deliver them to the Government daily.

3.4.2 Transporting and Transfer-Spreading Operations

The transporting and transfer equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein.

All equipment shall be kept clean and in operable condition at all times. Non-agitating equipment shall be used only on smooth roads and for haul time less than 15 minutes.

An approved transfer spreader shall be used to transfer the concrete from hauling equipment outside the paving lane and to spread it evenly and strike it off to approximate grade in front of the paver-finisher. A travelling surge hopper can also be used to accept the concrete from the transporting equipment, store it as necessary, and feed it evenly across the paving lane at a depth which permits the paver to operate efficiently and at a rate that permits the paver to have a continuous forward movement.

Concrete shall be deposited as close as possible to its final position in the paving lane. All equipment shall be operated to discharge and transfer concrete without segregation. Dumping of concrete directly in front of the paver may be allowed if no damage is done to the underlying material and its degree of compaction, as determined by the Government. This procedure, if proposed, shall be evaluated during the test section. No transfer or spreading operation which requires the use of front-end loaders, dozers, or similar equipment to distribute the concrete will be permitted. All batching and mixing, transporting, transferring, paving, and finishing shall be properly coordinated and controlled such that the paver-finisher has a continuous forward movement at a reasonably uniform speed from beginning to end of each paving lane, except for inadvertent equipment breakdown. Failure to achieve this shall require the Contractor to halt operations, regroup, and modify operations to achieve this requirement

3.5 PAVING

Pavement shall be constructed with paving and finishing equipment utilizing fixed forms or slipforms.

3.5.1 Consolidation

The paver vibrators shall be inserted into the concrete not closer to the underlying material than 2 inches. The vibrators or any tamping units in front of the paver shall be automatically controlled so that they shall be stopped immediately as forward motion ceases. Excessive vibration shall not be permitted. Concrete in small, odd-shaped slabs or in locations inaccessible to the paver mounted vibration equipment shall be vibrated with a hand-operated immersion vibrator. Vibrators shall not be used to transport or spread the concrete.

3.5.2 Operation

When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), provisions shall be made to prevent damage to the previously constructed pavement, including keeping the existing pavement surface free of any debris, and placing rubber mats beneath the paver

tracks. Transversely oscillating screeds and extrusion plates shall overlap the existing pavement the minimum possible, but in no case more than 8 inches.

3.5.3 Required Results

The paver-finisher shall be operated to produce a thoroughly consolidated slab throughout, true to line and grade within specified tolerances. The paver-finishing operation shall produce a surface finish free of irregularities, tears, voids of any kind, and any other discontinuities. It shall produce only a very minimum of paste at the surface. Multiple passes of the paver-finisher shall not be permitted. The equipment and its operation shall produce a finished surface requiring no hand finishing, other than the use of cutting straightedges, except in very infrequent instances. No water, other than true fog sprays (mist), shall be applied to the concrete surface during paving and finishing.

3.5.4 Fixed Form Paving

Forms shall be steel, except that wood forms may be used for curves having a radius of 150 feet or less, and for fillets. Forms may be built up with metal or wood, added only to the base, to provide an increase in depth of not more than 25 percent. The base width of the form shall be not less than eight-tenths of the vertical height of the form, except that forms 8 inches or less in vertical height shall have a base width not less than the vertical height of the form. Wood forms for curves and fillets shall be adequate in strength and rigidly braced. Forms shall be set on firm material cut true to grade so that each form section when placed will be firmly in contact with the underlying layer for its entire base. Forms shall not be set on blocks or on built-up spots of underlying material. Forms shall remain in place at least 12 hours after the concrete has been placed. Forms shall be removed without injuring the concrete.

3.5.5 Slipform Paving

The slipform paver shall shape the concrete to the specified and indicated cross section in one pass, and shall finish the surface and edges so that only a very minimum amount of hand finishing is required. Dowels shall not be installed by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete.

3.5.6 Placing Reinforcing Steel

The type and amount of steel reinforcement shall be as shown on the drawings. For pavements less than 12 inches thick, the reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement. Concrete shall be vibrated after the steel has been placed. Regardless of placement procedure, the reinforcing steel shall be free from coatings which could impair bond between the steel and concrete, and laps in the reinforcement shall be as indicated. In lieu of the above, automatic reinforcement depressing attachments (bar mats) may be used to position the reinforcement, provided the entire operation is approved by the Contracting Officer. Regardless of the equipment or procedures used for installing reinforcement, the Contractor shall ensure that the entire depth of concrete is adequately consolidated.

3.5.7 Placing Dowels and Tie Bars

Dowels shall be installed with alignment not greater than 1/8 inch per ft.

Except as otherwise specified below, location of dowels shall be within a horizontal tolerance of plus or minus 5/8 inch and a vertical tolerance of plus or minus 3/16 inch. The portion of each dowel intended to move within the concrete or expansion cap shall be painted with one coat of rust inhibiting primer paint, and then oiled just prior to placement. Dowels and tie bars (if necessary for repairs and replacement of slabs) in joints shall be omitted when the center of the dowel or tie bar is located within a horizontal distance from an intersecting joint equal to or less than one-fourth of the slab thickness.

3.5.7.1 Contraction Joints

Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal basket assemblies. The dowels and tie bars shall be welded to the assembly or held firmly by mechanical locking arrangements that will prevent them from becoming distorted during paving operations. The basket assemblies shall be held securely in the proper location by means of suitable anchors.

3.5.7.2 Construction Joints-Fixed Form Paving

Installation of dowels and tie bars shall be by the bonded-in-place method, supported by means of devices fastened to the forms. Installation by removing and replacing in preformed holes will not be permitted.

3.5.7.3 Dowels Installed in Hardened Concrete

Installation shall be by bonding the dowels into holes drilled into the hardened concrete. Holes approximately 1/8 inch greater in diameter than the dowels shall be drilled into the hardened concrete. Dowels shall be bonded in the drilled holes using epoxy resin injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel shall not be permitted. The dowels shall be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic collar fitted around the dowel. The vertical alignment of the dowels shall be checked by placing the straightedge on the surface of the pavement over the top of the dowel and measuring the vertical distance between the straightedge and the beginning and ending point of the exposed part of the dowel. Where tie bars are required in longitudinal construction joints of slipform pavement, bent tie bars shall be installed at the paver, in front of the transverse screed or extrusion plate. If tie bars are required, a standard keyway shall be constructed, and the bent tie bars shall be inserted into the plastic concrete through a 26 gauge thick metal keyway liner. Tie bars shall not be installed in preformed holes. The keyway liner shall be protected and shall remain in place and become part of the joint. Before placement of the adjoining paving lane, the tie bars shall be straightened, without spalling the concrete around the bar.

3.5.7.4 Expansion Joints

Dowels in expansion joints shall be installed by the bonded-in-place method or by bonding into holes drilled in hardened concrete, using procedures specified above.

3.6 FINISHING

Clary screeds, "bridge deck" finishers, or other rotating pipe or tube type equipment shall not be permitted. The sequence of machine operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Hand finishing shall be used only infrequently and only on isolated areas of odd slab shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Equipment to be used for supplemental hand finishing shall primarily be 10 to 12 feet cutting straightedges; only very sparing use of bull floats shall be allowed. At no time shall water be added to the surface of the slab in any way, except for fog (mist) sprays to prevent plastic shrinkage cracking.

3.6.1 Machine Finishing With Fixed Forms

The machine shall be designed to ride the forms. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

3.6.2 Machine Finishing With Slipform Pavers

If there is sufficient concrete slurry or fluid paste on the surface that it runs over the edge of the pavement, the paving operation shall be immediately stopped and the equipment, mixture, or operation modified to prevent formation of such slurry. Any slurry which does run down the vertical edges shall be immediately removed. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

3.6.3 Surface Correction

While the concrete is still plastic, irregularities and marks in the pavement surface shall be eliminated by means of cutting straightedges, 10 to 12 feet in length. Depressions shall be filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. Long-handled, flat "bull floats" shall be used sparingly and only as necessary to correct minor, scattered surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished.

3.6.4 Hand Finishing

Hand finishing operations shall be used only for those unusual slabs as specified previously. Grate tampers (jitterbugs) shall not be used. As soon as placed and vibrated, the concrete shall be struck off and screeded. The surface shall be tamped with a strike-off and tamping screed, or vibratory screed. Immediately following the final tamping of the surface, the pavement shall be floated longitudinally. Long-handled, flat bull floats shall be used sparingly and only as necessary to correct surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished. No water shall be added to the pavement during finishing operations.

3.6.5 Texturing

Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. Following initial texturing on the first day of placement, the Placing Foreman, Contracting Officer representative, and a representative of the Using Agency shall inspect the texturing for compliance with design requirements. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris. Any type of transverse texturing shall produce grooves in straight lines across each lane within a tolerance of plus or minus 1/2 inch of a true line. The concrete in areas of recesses for tie-down anchors, lighting fixtures, and other outlets in the pavement shall be finished to provide a surface of the same texture as the surrounding area.

3.6.5.1 Fabric-Drag Surface Finish

Surface texture shall be applied by dragging the surface of the pavement, in the direction of the concrete placement, with a moist fabric drag. The dragging shall produce a uniform finished surface having a fine sandy texture without disfiguring marks.

3.6.6 Edging

The edges of slipformed lanes shall not be edged. After texturing has been completed, the edge of the slabs along the forms shall be carefully finished with an edging tool to form a smooth rounded surface of 1/8 inch radius. No water shall be added to the surface during edging.

3.7 CURING

Concrete shall be continuously protected against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing operations. Unhardened concrete shall be protected from rain and flowing water. During hot weather with low humidity and/or wind, the Contractor shall institute measures to prevent plastic shrinkage cracks from developing. ACI 305R contains means of predicting plastic shrinkage cracking and preventative measures. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry. Curing shall be accomplished by one of the following methods.

3.7.1 Membrane Curing

A uniform coating of white-pigmented membrane-forming curing compound shall be applied to the entire exposed surface of the concrete including pavement edges as soon as the free water has disappeared from the surface after finishing. If evaporation is high and no moisture is present on the surface even though bleeding has not stopped, fog sprays shall be used to keep the surface moist until setting of the cement occurs. Curing compound shall then be immediately applied. Curing compound shall be applied to the finished surfaces by means of a self-propelled automatic spraying machine, equipped with multiple spraying nozzles with wind shields, spanning the newly paved lane. The curing compound shall be applied at a maximum application rate of 200 square feet per gallon. The application of curing compound by hand-operated, mechanical powered pressure sprayers will be permitted only on odd widths or shapes of slabs where indicated and on concrete surfaces exposed by the removal of forms. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel and that will be free from pinholes and other discontinuities. Areas where

the curing compound develops the above defects or is damaged by heavy rainfall, sawing or other construction operations within the curing period, shall be immediately resprayed.

3.7.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Impervious sheet curing shall not be used.

3.8 JOINTS

No deviation from the jointing pattern shown on the drawings shall be made without written approval of the Design District Pavement or Geotechnical Engineer. All joints shall be straight, perpendicular to the finished grade of the pavement, and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 1/2 inch.

3.8.1 Longitudinal Construction Joints

Longitudinal construction joints between paving lanes shall be located as indicated. Dowels shall be installed in the longitudinal construction joints, or the edges shall be thickened as indicated. Dowels shall be installed in conformance with paragraph, Placing Dowels and Tie Bars. After the end of the curing period, longitudinal construction joints shall be sawed to provide a groove at the top for sealant conforming to the details and dimensions indicated.

3.8.2 Transverse Construction Joints

Transverse construction joints shall be installed at a planned transverse joint, at the end of each day's placing operations and when concrete placement is interrupted. Transverse construction joints shall be constructed either by utilizing headers and hand placement and finishing techniques, or by placing concrete beyond the transverse construction joint location and then saw cutting full depth and removing concrete back to the transverse construction joint location. For the latter case, dowels shall be installed using methods for dowels installed in hardened concrete described above. All transverse construction joints shall be dowelled.

3.8.3 Expansion Joints

Expansion joints shall be formed where indicated, and about any structures and features that project through or into the pavement, using preformed joint filler of the type, thickness, and width indicated, and shall extend the full slab depth. Edges of the concrete at the joint face shall be edged. The joint filler strips shall be installed to form a recess at the pavement surface to be filled with joint sealant. Expansion joints shall be constructed with thickened edges for load transfer.

3.8.4 Slip Joints

Slip joints shall be installed the full depth of the slab using expansion joint preformed joint filler material attached to the face of the original concrete placement. A reservoir for joint sealant shall be constructed at the top of the joint. Edges of the joint face shall be edged.

3.8.5 Contraction Joints

Transverse and longitudinal contraction joints shall be of the weakened-plane or dummy type. Longitudinal contraction joints shall be constructed by sawing a groove in the hardened concrete with a power-driven saw. Transverse contraction joints shall be constructed in conformance with requirements for sawed joints.

3.8.5.1 Sawed Joints

Sawed contraction joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the indicated depth. The time of initial sawing shall vary depending on existing and anticipated weather conditions and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. Sawing at a given joint location shall be discontinued when a crack develops ahead of the saw cut. Immediately after the joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. The surface shall be resprayed with curing compound as soon as free water disappears. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed with cord or backer rod before the concrete in the region of the joint is resprayed with curing compound.

3.8.6 Thickened Edge Joints

Underlying material in the transition area shall meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

3.9 REPAIR, REMOVAL, AND REPLACEMENT OF SLABS

New pavement slabs that contain full-depth cracks shall be removed and replaced, as specified herein at no cost to the Government. Removal and replacement shall be full depth, shall be full width of the paving lane, and the limit of removal shall be from each original transverse joint. The Contracting Officer will determine whether cracks extend full depth of the pavement and may require minimum 6 inch diameter cores to be drilled on the crack to determine depth of cracking. Cores shall be drilled and the hole later filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin. Drilling of cores and refilling holes shall be at no expense to the Government. Cracks that do not extend full depth of slab shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1. The Contractor shall ensure that the crack is not widened during epoxy resin injection. Where a full depth crack intersects the original transverse joint, the slab(s) containing the crack shall be removed and replaced, with dowels installed, as required below. Spalls along joints shall be repaired as specified.

3.9.1 Removal and Replacement of Full Slabs

Unless there are keys or dowels present, all edges of the slab shall be sawcut full depth. If keys, dowels, or tie bars are present along any edges, these edges shall be sawed full depth 6 inches from the edge if only keys are present, or just beyond the end of dowels or tie bars if they

are present. These joints shall then be carefully sawed on the joint line to within 1 inch of the depth of the dowel or key. The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. The narrow strips along keyed or doweled edges shall be carefully broken up and removed. Care shall be taken to prevent damage to the dowels, tie bars, or keys or to concrete to remain in place. Protruding portions of dowels shall be painted and lightly oiled. The joint face below keys or dowels shall be suitably trimmed so that there is no abrupt offset. If underbreak occurs at any point along any edge, the area shall be hand-filled with concrete, producing an even joint face from top to bottom, before replacing the removed slab. If underbreak over 4 inches deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels, tie bars, or keys on an edge, or where they have been damaged, dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete. Original damaged dowels or tie bars shall be cut off flush with the joint face. All four edges of the new slab shall thus contain dowels or original keys or original tie bars. Prior to placement of new concrete, the underlying material shall be graded and recompact, and the surfaces of all four joint faces shall be cleaned of all loose material and contaminants, and coated with a double application of membrane forming curing compound as bond breaker. Placement of concrete shall be as specified for original construction. The resulting joints around the new slab shall be prepared and sealed as specified.

3.9.2 Repairing Spalls Along Joints

Spalls along joints and cracks shall be repaired by first making a vertical saw cut at least 1 inch outside the spalled area and to a depth of at least 2 inches. Saw cuts shall be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, shall be chipped out to remove all unsound concrete. The cavity shall be thoroughly cleaned with high pressure water jets supplemented with compressed air to remove all loose material. Immediately before filling the cavity, a prime coat shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Prime coat for portland cement repairs shall be a neat cement grout and for epoxy resin repairs shall be epoxy resin, Type III, Grade 1. The cavity shall be filled with low slump portland cement concrete or mortar, or with epoxy resin concrete or mortar. Portland cement concrete shall be used for larger spalls, those more than 1/3 cu. ft. in size after removal operations; portland cement mortar shall be used for spalls between 0.03 and 1/3 cu. ft.; and epoxy resin mortar or Type III, Grade 3 epoxy resin for those spalls less than 0.03 cu. ft. in size after removal operations. Portland cement concretes and mortars shall be very low slump mixtures, proportioned, mixed, placed, tamped, and cured. If the materials and procedures are approved in writing, latex modified concrete mixtures may be used for repairing spalls less than 1/3 cu.ft. in size. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions, mixing, placing, tamping and curing procedures as recommended by the manufacturer. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints. In lieu of sawing, spalls not adjacent to joints, and popouts, both less than 6 inches in maximum dimension, may be prepared by drilling a core 2 inches

in diameter greater than the size of the defect, centered over the defect, and 2 inches deep or 1/2 inch into sound concrete, whichever is greater. The core hole shall be repaired as specified above for other spalls.

3.9.3 Areas Defective in Plan Grade or Smoothness

In areas not meeting the specified limits for surface smoothness and plan grade, high areas shall be reduced to attain the required smoothness and grade, except as depth is limited below. High areas shall be reduced by grinding the hardened concrete with a surface grinding machine after the concrete is 14 days or more old. The depth of grinding shall not exceed 1/4 inch. All pavement areas requiring plan grade or surface smoothness corrections in excess of the specified limits, shall be removed and replaced. In pavement areas given a wire comb or tined texture, areas exceeding 25 square feet that have been corrected by rubbing or grinding shall be retextured by grooving machine sawn grooves meeting the requirements for the wire comb or tined texture. All areas in which grinding has been performed will be subject to the thickness tolerances specified in paragraph Thickness. Any grinding performed on individual slabs with excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal of the slab is required.

3.10 PAVEMENT PROTECTION

The Contractor shall protect the pavement against all damage prior to final acceptance of the work. Traffic shall be excluded from the new pavement. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling equipment will be permitted on the new pavement after the pavement has been cured for 7 days and the joints have been sealed or otherwise protected. All new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean.

3.11 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL (CQC)

Paragraph ACCEPTABILITY OF WORK contains additional CQC requirements. The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and submit reports as specified. When, in the opinion of the Contracting Officer, the paving operation is out of control, concrete placement shall cease.

3.11.1 Batch Plant Control

A daily report shall be prepared indicating checks made for scale accuracy with test weights, checks of batching accuracy, and corrective action taken prior to and during placement for weighing or batching, type and source of cement used, type and source of pozzolan used, amount and source of admixtures used, aggregate source, the required aggregate and water masses per cubic yd, amount of water as free moisture in each size of aggregate, aggregate gradation and the batch aggregate and water masses per cubic yd. for each class of concrete batched during each day's plant operation.

3.11.2 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made on randomly selected batches of concrete for each 250 cubic yards, or fraction thereof, of concrete placed during each 8-hour shift. Whenever

air content reaches specified limits, an immediate confirmatory test shall be made. If the second test also shows air content at or exceeding specified limits, an adjustment shall immediately be made in the amount of air-entraining admixture batched to bring air content within specified limits. If the next adjusted batch of concrete is not within specified limits, concrete placement shall be halted until concrete air content is within specified limits.

- b. Slump Testing. Slump tests shall be made on randomly selected batches of concrete for each 250 cubic yards, or fraction thereof, of concrete placed during each 8-hour shift. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Whenever slump approaches the maximum limit, an adjustment shall immediately be made in the batch masses of water and fine aggregate, without exceeding the maximum $w/(c+p)$. When a slump result exceeds the specification limit, no further concrete shall be delivered to the paving site until adjustments have been made and slump is again within the limit.
- c. Temperature. The temperature of the concrete shall be measured every 250 cubic yards, or fraction thereof, of concrete placed during an 8-hour shift.
- d. Concrete Strength Testing. Four (4) cylinders from the same batch shall be fabricated, cured and tested for compressive strength, testing two cylinders at 7-day and two cylinders at 28-day age. The four cylinders shall be made for each 500 cubic yards, or fraction thereof of concrete placed during an 8-hour shift. Control charts for strength, showing the 7-day and 28-day CQC compressive strengths, and the 28-day required compressive strength, shall be maintained and submitted with weekly CQC Reports.

3.11.3 Inspection Before Placing

Underlying materials, joint locations and types, construction joint faces, forms, reinforcing, dowels, and embedded items shall be inspected by a Registered Engineer in sufficient time prior to each paving operation in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing, and the certification signed by the Registered Engineer, prior to each days' paving.

3.11.4 Paving Operations

The placing foreman shall supervise all placing and paving operations, shall determine that the correct quality of concrete is placed in each location as shown, shall insure that the concrete is consolidated full depth and that finishing is performed as specified. The placing foreman shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume of concrete placed, and method of paving and any problems encountered.

3.11.5 Curing Inspection

- a. Moist Curing Inspections. Each day on both work and non-work

days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded. When any inspection finds an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for the area shall be extended by 1 day.

- b. Membrane Curing Inspection. At the end of each day's placement, the CQC Representative shall determine the quantity of compound used by measurement of the container; shall determine the area of concrete surface covered; shall then compute the rate of coverage in square feet per gallon and shall also note whether or not coverage is uniform. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

3.11.6 Cold-Weather Protection

At least once per day, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.11.7 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report, signed by a registered engineer, shall be prepared for the updating of control charts and test data, and all CQC inspections and actions covering the entire period from the start of the construction through the current week. Reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all CQC records. A copy of weekly reports shall be faxed to the Design District Pavement or Geotechnical Engineer. At the completion of concrete placement, a certification report shall be prepared containing mix designs, all updated control charts and concrete test data, quality control reports, smoothness reports, and other pertinent data on the concrete, with a certification by a registered engineer that the concrete placed meets all specification requirements. A copy of the certification report shall be mailed to the Design District pavement or Geotechnical Engineer.

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SECTION 02762

COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in this text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2628	(1991) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D 2835	(1989; R 1993) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements

1.2 SAFETY

Compression joint seals shall not be placed within 25 feet of liquid oxygen (LOX) equipment, LOX storage, or LOX piping.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government: "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-05 Design Data

Test Reports; G

Certified copies of test results shall be provided 30 days prior to use of material on the project.

Equipment List; G

List of proposed equipment to be used in the performance of construction work, including descriptive data shall be provided 30 days prior to use on the project.

Manufacturer's Instructions; G

Where installation procedures are required in accordance with the manufacturer's recommendations, printed copies of manufacturers'

instructions, 15 days prior to use on the project.

SD-04, Samples

Compression Seals; G

Regardless of testing responsibility, 4-foot long samples of the materials shall be submitted for approval 30 days prior to use on the project. Printed directions from the manufacturer on recommended installation criteria shall be furnished with the samples plus the manufacturer's certification that the selected seal is recommended for the installation on this project.

1.4 TEST REQUIREMENTS

Each lot of compression joint seal and lubricant/adhesive shall be sampled, identified, and tested for conformance with the applicable material specification. A lot of compression seal shall consist of 1 day's production or 20,000 linear feet for each cross section, whichever is less.

A lot of lubricant/adhesive shall consist of 1 day's production. Testing of the compression joint seal and lubricant/adhesive material shall be the responsibility of the Contractor and shall be performed in an approved independent laboratory, and certified copies of the test reports shall be submitted for approval 30 days prior to the use of the materials at the jobsite. Samples of each lot of material shall also be submitted and will be retained by the Government for possible future testing should the materials appear defective during or after application. The Contractor shall furnish additional samples of materials, in sufficient quantity to be tested, upon request. Final acceptance will be based on conformance to the specified test requirements and the performance of the in-place materials.

1.5 EQUIPMENT

Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times. An equipment list shall be submitted to the Government 30 days prior to use on the project.

1.5.1 Joint Cleaning Equipment

1.5.1.1 Concrete Saw

A self-propelled power saw with water-cooled diamond saw blades shall be provided for cutting joints to the depths and widths specified and for removing filler, existing old joint seal, or other material embedded in the joints or adhered to the joint faces.

1.5.1.2 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hose, and a long-wearing venturi-type nozzle of proper size, shape, and opening. The maximum nozzle opening should not exceed 1/4 inch. The air compressor shall be portable and shall be capable of furnishing not less than 150 cubic feet per minute and maintaining a line pressure of not less than 90 psi at the nozzle while in use. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint about 1 inch above the pavement surface and will direct the blast to clean the joint walls. The height, angle of inclination, and the

size of the nozzle shall be adjusted as necessary to ensure satisfactory results.

1.5.1.3 Waterblasting Equipment

Waterblasting equipment shall include a trailer-mounted water tank, pumps, high-pressure hose, a wand with safety release cutoff controls, nozzle, and auxiliary water resupply equipment. The water tank and auxiliary water resupply equipment shall be of sufficient capacity to permit continuous operations. The pumps, hoses, wand, and nozzle shall be of sufficient capacity to permit the cleaning of both walls of the joint and the pavement surface for a width of at least 1/2 inch on either side of the joint. A pressure gauge mounted at the pump shall show at all times the pressure in pounds per square inch at which the equipment is operating.

1.5.2 Sealing Equipment

Equipment used to install the compression seal shall place the compression seal to the prescribed depths within the specified tolerances without cutting, nicking, twisting, or otherwise damaging the seal. The equipment shall be capable of placing the seal with not more than two percent longitudinal stretch or compression of the seal during installation. The machine shall be an automatic self-propelled joint seal application equipment and engine powered. The machine shall include a reservoir for the lubricant/adhesive, a device for conveying the lubricant/adhesive in the proper quantities to the sides of the compression seal or the sidewalls of the joints, a reel capable of holding one full spool of compression seal, and a power-driven apparatus for feeding the joint seal through a compression device and inserting the seal into the joint. The equipment shall also include a guide to maintain the proper course along the joint being sealed. The machine shall at all times be operated by an experienced operator.

1.6 TRIAL JOINT SEAL AND LUBRICANT/ADHESIVE INSTALLATION

Prior to the cleaning and sealing of the joints for the entire project, a test section at least 200 feet long shall be prepared at a designated location in the project pavement using the specified materials and the approved equipment, so as to demonstrate the proposed joint preparation and sealing of all types of joints in the project. Following the completion of the trial length and before any other joint is sealed, the trial joints will be inspected by the Government to determine that the materials and installation meet the requirements specified. If materials or installation do not meet requirements, the materials shall be removed, and the joints shall be recleaned and resealed at no cost to the Government. No other joints shall be sealed until the test installation has been approved. If the trial section is approved, it may be incorporated into the permanent work. Other joints shall be sealed in the manner approved for sealing the trial joint.

1.7 DELIVERY AND STORAGE

Materials delivered to the jobsite shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall protect materials from weather and shall maintain materials at temperatures recommended by the manufacturer.

1.8 ENVIRONMENTAL CONDITIONS

The ambient temperature and the pavement temperature within the joint wall shall be at least of 35 degrees F and rising at the time of installation of the materials. Sealant installation will not be allowed if moisture or foreign material is observed in the joint.

PART 2 PRODUCTS

2.1 COMPRESSION SEALS

Compression joint seal materials shall be a vulcanized elastomeric compound using polychloroprene as the only base polymer. The material and manufactured seal shall conform to ASTM D 2628. The joint seal shall be a labyrinth type seal. The uncompressed depth of the face of the compression seal (that is to be bonded to the joint wall) shall be greater than the uncompressed width of the seal, except that for seals 1 inch or greater in width, the depth need be only 1 inch or greater. The actual width of the uncompressed seal shall be 13/16 inch or 1 inch with a tolerance of plus 1/8 inch and minus 1/16 inch.

2.2 LUBRICANT/ADHESIVE

Lubricant/adhesive used for the compression elastomeric joint seal shall be a one-component compound conforming to ASTM D 2835.

PART 3 EXECUTION

3.1 PREPARATION OF JOINTS

Immediately before installation of the compression joint seal, the joints shall be thoroughly cleaned to remove laitance, filler, existing sealer, foreign material and protrusions of hardened concrete from the sides and upper edges of the joint space to be sealed. Cleaning shall be by sandblasting or waterblasting and shall extend along pavement surfaces at least 1/2 inch on either side of the joint. After final cleaning and immediately prior to sealing, the joints shall be blown out with compressed air and left completely free of debris and water. The Contractor shall demonstrate that the selected cleaning operation meets the cleanliness requirements. Any irregularity in the joint face which would prevent uniform contact between the joint seal and the joint face shall be corrected prior to the installation of the joint seal.

3.1.1 Sawing

Joints shall be cleaned and to opened to the specified width and depth by sawing. Immediately following the sawing operation, the joint faces and opening shall be thoroughly cleaned using a water jet to remove saw cuttings or debris remaining on the faces or in the joint opening. Compression seal shall be installed within 3 calendar days of the time the joint cavity is sawed. Depth of the joint cavity will be as recommended by the seal manufacturer. The saw cut for the joint seal cavity shall be centered over the joint line. The nominal width of the sawed joint seal cavity shall be as follows; the actual width shall be within a tolerance of plus or minus 1/16 inch.

3.1.2 Sandblast Cleaning

A multiple pass sandblasting technique shall be used until the surfaces are free of dust, dirt, curing compound, or any residue that might prevent

ready insertion or uniform contact of the seal and bonding of the lubricant/adhesive to the concrete.

3.1.3 Rate of Progress

Sandblasting of joint faces shall be limited to the length of joint that can be sealed during the same workday.

3.2 INSTALLATION OF THE COMPRESSION SEAL

3.2.1 Time of Installation

Joints shall be sealed immediately within 3 calendar days of sawing the joint seal cavity and following concrete cure and the final cleaning of the joint walls. Open joints ready for sealing that cannot be sealed under the specified conditions shall be provided with an approved temporary seal to prevent infiltration of foreign material. When rain interrupts the sealing operations, the joints shall be washed, air pressure cleaned, and allowed to dry prior to installing the lubricant/adhesive and compression seal.

3.2.2 Sequence of Installation

Longitudinal joints shall be sealed first, followed by transverse joints. Seals in longitudinal joints shall be installed so that all transverse joint seals will be intact from edge to edge of the pavement. Intersections shall be made monolithic by use of joint seal adhesive and care in fitting the intersection parts together. Extender pieces of seal shall not be used at intersections. Any seal falling short at the intersection shall be removed and replaced with new seal at no additional cost to the Government. Seals that are required to change direction by more than 20 degrees, may require a poured sealant at the intersection. Poured sealant shall be as recommended by the compression seal manufacturer.

3.3 SEALING OF JOINTS

The sides of the joint seal or the sides of the joint shall be covered with a coating of lubricant/adhesive and the seal installed in such a manner as to conform to all requirements specified. Butt joints and seal intersections shall be coated with liberal applications of lubricant/adhesive. Lubricant/adhesive spilled on the pavement shall be removed immediately to prevent setting on the pavement. The in-place joint seal shall be in an upright position and free from twisting, distortion, and cuts. Adjustments shall be made to the installation equipment and procedure, if the stretch or compression exceeds 2 percent. Any seal exceeding 2 percent stretch or compression shall be removed and replaced. The joint seal shall be placed at a uniform depth within the tolerances specified. In-place joint seal which fails to meet the specified requirements shall be removed and replaced with new joint seal at no cost to the Government. The compression joint seal shall be placed to a depth of 1/4 inch, plus or minus 1/8 inch, below the pavement surface except when the joint is beveled or has a radius at the surface, or unless otherwise directed. For beveled joints or joints with a radius at the surface, the compression joint seal shall be installed at a depth of 1/8 inch, plus or minus 1/8 inch, below the bottom of the edge of the bevel or radius. No part of the seal shall be allowed to project above the surface of the pavement or above the edge of the bevel or radius. The seal shall be installed in the longest practicable lengths in longitudinal joints and shall be cut at the joint intersections to provide continuous installation of the seal in the transverse joints. The lubricant/adhesive in the

longitudinal joints shall be allowed to set for 1 hour prior to cutting at the joint intersections to reduce the possibility of shrinkage. For all transverse joints, the minimum length of the compression joint seal shall be the pavement width from edge to edge.

3.4 CLEAN-UP

Upon completion of the project, all unused materials shall be removed from the site, any lubricant/adhesive on the pavement surface shall be removed, and the pavement shall be left in clean condition.

3.5 QUALITY CONTROL PROVISIONS

3.5.1 Equipment

The application equipment shall be inspected to assure uniform application of lubricant/adhesive to the sides of the compression joint seal or the walls of the joint. If any equipment causes cutting, twisting, nicking, excessive stretching or compressing of the seal, or improper application of the lubricant/adhesive, the operation will be suspended until causes of the deficiencies are determined and corrected.

3.5.2 Procedures

3.5.2.1 Quality Control Inspection

Quality control provisions shall be provided during the joint cleaning process to prevent or correct improper equipment and cleaning techniques that damage the concrete in any manner. Cleaned joints shall be approved by the Government prior to installation of the lubricant/adhesive and compression joint seal.

3.5.2.2 Conformance to Stretching and compression Limitations

Conformance to stretching and compression limitations shall be determined. The top surface of the compression seal shall be marked at 1 foot intervals in a manner clear and durable to enable length determinations of the seal. After installation, the distance between the marks shall be measured on the seal. If the stretching or compression exceeds 2 percent, the seal shall be removed and replaced with new joint at no additional cost to the Government. The seal shall be removed up to the last correct measurement. The seal shall be inspected a minimum of once per 100 feet of seal for compliance to the shrinkage or compression requirements. Measurements shall also be made at the same interval to determine conformance with depth and width of installation requirements. Compression seal that is not in conformance with specification requirements shall be removed and replaced with new joint seal at no additional cost to the Government.

3.5.2.3 Pavement Temperature

The pavement temperature shall be determined by placing a thermometer in the initial saw cut for the joint and the reading shall be recorded. The thermometer shall remain in the joint for an adequate time to provide a control reading.

3.5.3 Product

The joint sealing system (compression seal and lubricant/adhesive) shall be inspected for proper rate of cure and bonding to the concrete, cuts,

twists, nicks and other deficiencies. Seals exhibiting any defects, at any time prior to final acceptance of the project, shall be removed from the joint, wasted, and replaced in a satisfactory manner.

-- End of Section --

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SECTION 02763A

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SECTION 02763A
PAVEMENT MARKINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 247	(1981; R 1996) Glass Beads Used in Traffic Paint
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 792	(1998) Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D 4280	(1996) Extended Life Type, Nonplowable, Prismatic, Raised, Retroreflective Pavement Markers
ASTM D 4505	(1996) Preformed Plastic Pavement Marking Tape for Extended Service Life
ASTM E 28	(1999) Softening Point of Resins by Ring and Ball Apparatus

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-B-1325	(Rev C; Notice 1; Canc. Notice 2) Beads (Glass Spheres) Retro-Reflective (Metric)
FS TT-P-1952	(Rev D; Canc. Notice 1) Paint, Traffic and Airfield Marking, Waterborne (Metric)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment; G

Lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation.

Composition Requirements

Manufacturer's current printed product description and Material Safety Data Sheets (MSDS) for each type paint/color proposed for use.

Qualifications

Document certifying that personnel are qualified for equipment operation and handling of chemicals.

SD-06 Test Reports

Sampling and Testing

Certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory.

SD-07 Certificates

Volatile Organic Compound (VOC)

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

1.3 DELIVERY AND STORAGE

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.4 EQUIPMENT

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.

1.4.1 Paint Application Equipment

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 5 mph, and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph APPLICATION, and of even uniform thickness with clear-cut edges. Equipment used for marking streets and highways shall be capable of placing the prescribed number of lines at a

single pass as solid lines, intermittent lines or a combination of solid and intermittent lines using a maximum of two different colors of paint as specified. The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

1.4.2 Reflective Media Dispenser

The dispenser for applying the reflective media shall be attached to the paint dispenser and shall operate automatically and simultaneously with the applicator through the same control mechanism. The dispenser shall be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION, at all operating speeds of the applicator to which it is attached.

1.4.3 Surface Preparation Equipment

1.4.3.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

1.4.3.2 Waterblast Equipment

The water pressure shall be specified at 2600 psi at 140 degrees F in order to adequately clean the surfaces to be marked.

1.4.4 Marking Removal Equipment

Equipment shall be mounted on rubber tires and shall be capable of removing markings from the pavement without damaging the pavement surface or joint sealant. Waterblasting equipment shall be capable of producing an adjustable, pressurized stream of water. Sandblasting equipment shall include an air compressor, hoses, and nozzles. The compressor shall be equipped with traps to maintain the air free of oil and water.

1.4.4.1 Shotblasting Equipment

Shotblasting equipment shall be capable of producing an adjustable depth of removal of marking and pavement. Each unit shall be self-cleaning and self-contained, shall be able to confine dust and debris from the operation, and shall be capable of recycling the abrasive for reuse.

1.4.4.2 Chemical Equipment

Chemical equipment shall be capable of application and removal of chemicals from the pavement surface, and shall leave only non-toxic biodegradeable residue.

1.4.5 Traffic Controls

Traffic Control shall be in compliance with Section 12 of CALTRANS Standard Specifications. Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

1.5 HAND-OPERATED, PUSH-TYPE MACHINES

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

1.6 MAINTENANCE OF TRAFFIC

1.6.1 Roads, Streets, and Parking Areas

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

1.7 WEATHER LIMITATIONS FOR REMOVAL

Pavement surface shall be free of snow, ice, or slush. Surface temperature shall be at least 40 degrees F and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals. Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

PART 2 PRODUCTS

2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for airfields, roads, and streets shall conform to FS TT-P-1952, color as indicated. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

2.2 RAISED REFLECTIVE MARKERS

Either metallic or nonmetallic markers of the button or prismatic reflector type may be used. Markers shall be of permanent colors, as specified for pavement marking, and shall retain the color and brightness under the action of traffic. Button markers shall have a diameter of not less than 4 inches, and shall be spaced not more than 40 feet apart on solid longitudinal lines. Broken centerline marker spacings shall be in segments indicated with gaps indicated between segments. Markers shall have rounded surfaces presenting a smooth contour to traffic and shall not project more than 3/4 inch above level of pavement. Pavement markers and adhesive epoxy shall conform to ASTM D 4280.

2.3 REFLECTIVE MEDIA

Reflective media for roads and streets shall conform to FS TT-B-1325, Type I, Gradation A or AASHTO M 247, Type I.

2.4 SAMPLING AND TESTING

Materials proposed for use shall be stored on the project site in sealed and labeled containers, or segregated at source of supply, sufficiently in advance of needs to allow 60 days for testing. Upon notification by the Contractor that the material is at the site or source of supply, a sample shall be taken by random selection from sealed containers by the Contractor in the presence of a representative of the Contracting Officer. Samples shall be clearly identified by designated name, specification number, batch number, manufacturer's formulation number, project contract number, intended use, and quantity involved. Testing shall be performed in an approved independent laboratory. If materials are approved based on reports furnished by the Contractor, samples will be retained by the Government for possible future testing should the material appear defective during or after application.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

3.1.1 Pretreatment for Early Painting

Where early painting is required on rigid pavements, a pretreatment with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride shall be applied to prepared pavement areas prior to painting.

3.1.2 Cleaning Existing Pavement Markings

In general, markings shall not be placed over existing pavement marking patterns. Existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns, shall be removed. Deteriorated or obscured markings that are not misleading or confusing or interfere with the adhesion of the new marking material do not require removal. New preformed and thermoplastic pavement markings shall not be applied over existing preformed or thermoplastic markings. Whenever grinding, scraping, sandblasting or other operations are performed the work must be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.1.3 Cleaning Concrete Curing Compounds

On new Portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, thermoplastic and preformed markings shall be applied no sooner than 24 hours after the blasting has been completed. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

- a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.
- b. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.
- c. All remaining curing compound is intact; all loose and flaking material is removed.
- d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.
- e. The surface to be marked is dry.

3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint.

Paint shall be applied pneumatically with approved equipment at rate of coverage specified. The Contractor shall provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

3.2.1.1 Rate of Application

- a. Reflective Markings: Pigmented binder shall be applied evenly to the pavement area to be coated at a rate of 105 plus or minus 5 square feet

per gallon. Glass spheres shall be applied uniformly to the wet paint on road and street pavement at a rate of 6 plus or minus 0.5 pounds of glass spheres per gallon of paint.

b. Nonreflective Markings: Paint shall be applied evenly to the pavement surface to be coated at a rate of 105 plus or minus 5 square feet per gallon.

3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.2.2 Raised Reflective Markers

Prefabricated markers shall be aligned carefully at the required spacing and permanently fixed in place by means of epoxy resin adhesives. To insure good bond, pavement in areas where markers will be set shall be thoroughly cleaned by sandblasting and use of compressed air prior to applying adhesive.

3.2.3 Reflective Media

Application of reflective media shall immediately follow application of pigmented binder. Drop-on application of glass spheres shall be accomplished to insure that reflective media is evenly distributed at the specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, operations shall be discontinued immediately until deficiency is corrected.

3.3 MARKING REMOVAL

Pavement marking, shall be removed in the areas shown on the drawings. Removal of marking shall be as complete as possible without damage to the surface. Aggregate shall not be exposed by the removal process. After the markings are removed, the cleaned pavement surfaces shall exhibit adequate texture for remarking as specified in paragraph SURFACE PREPARATION. Contractor shall demonstrate removal of pavement marking in an area designated by the Contracting Officer. The demonstration area will become the standard for the remainder of the work.

3.3.1 Equipment Operation

Equipment shall be controlled and operated to remove markings from the pavement surface, prevent dilution or removal of binder from underlying pavement, and prevent emission of blue smoke from asphalt or tar surfaces.

3.3.2 Cleanup and Waste Disposal

The worksite shall be kept clean of debris and waste from the removal operations. Cleanup shall immediately follow removal operations in areas subject to air traffic. Debris shall be disposed of at approved sites.

-- End of Section --

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SECTION 02840A

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-- End of Section Table of Contents --

SECTION 02840A

ACTIVE VEHICLE BARRIERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO HB-16 (1996) Standard Specifications for Highway
Bridges

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 106 (1999e1) Seamless Carbon Steel Pipe for
High-Temperature Service

ASTM D 3034 (1998) Type PSM Poly(Vinyl Chloride) (PVC)
Sewer Pipe and Fittings

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (2000) Structural Welding Code - Steel

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1997) Enclosures for Electrical Equipment
(1000 Volts Maximum)

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J 517 (1998) Hydraulic Hose

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

FHWA SA-89-006 (1988) Manual on Uniform Traffic Control
Devices for Streets and Highways

UNDERWRITERS LABORATORIES (UL)

UL 486A (1997; Rev thru Dec 1998) Wire Connectors
and Soldering Lugs for Use with Copper
Conductors

1.2 GENERAL REQUIREMENTS

Barriers furnished shall in all respects be identical to the unit tested and certified . Crash test shall be performed and data compiled by an

approved independent testing agency. Test vehicle shall not vault or penetrate the barrier during the test. The design and structural materials of the vehicle barrier furnished shall be the same as those used in the crash tested barrier.

1.3 NAMEPLATES

Nameplate data shall be permanently attached to each vehicle barrier. The data shall be legibly marked on corrosion-resistant metal plates and shall consist of at least the following:

- a. Manufacturer's name.
- b. Model number.
- c. Serial number.
- d. Date of manufacture.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G, ED
Equipment; G, ED

Detail drawings containing complete wiring and schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including foundation and clearances for maintenance and operation. Detail drawings shall include a copy of the crash test report or certificate of barrier performance.

SD-03 Product Data

Vehicle Barriers; G
Spare Parts; G

A complete list of equipment, materials, including industrial standards used and how they apply to the applicable component and manufacturer's descriptive data and technical literature, catalog cuts, and installation instructions. Spare parts data for each different item of material and equipment used, after approval of the detail drawings. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Vehicle Barriers

Information necessary to document a minimum 1-year successful field operation performance history for each type of vehicle barrier installed.

SD-06 Test Reports

Field Testing

Test reports in booklet form showing all field tests, including component adjustments and demonstration of compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-10 Operation and Maintenance Data

Vehicle Barriers

Operating and Maintenance Instructions

Six copies of operation and maintenance manuals, a minimum of 2 weeks prior to field training. One complete set prior to performance testing and the remainder upon acceptance. Manuals shall be approved prior to acceptance. Operation manuals shall outline the step-by-step procedures required for system startup, operation, and shutdown. The manuals shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall include routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include piping layout, equipment layout, and simplified wiring and control diagrams of the system as installed. The manuals shall also include hydraulic oil types to be used for ambient temperature ranges of minus 30 degrees F to 150 degrees F to cover winter operation, summer operation, and ambient temperature ranges in between.

1.5 DELIVERY AND STORAGE

Components placed in storage shall be protected from the weather, humidity, and temperature variation, dirt and dust, or other contaminants. Structural materials shall be stored on sleepers or pallets and shall be protected from rust and objectionable materials such as dirt, grease, or oil.

1.6 SPARE PARTS

A manufacturer's standard recommended spare parts package, with current unit prices and source of supply complete with detailed manuals on parts replacement, shall be provided with each barrier to facilitate 1 year of normal operation. Particular consideration shall be given to system components which are not readily available from local or commercial sources and which are critical to the operation of the system.

PART 2 PRODUCTS

2.1 RETRACTABLE BOLLARDS

The total bollard height when in the raised position shall be no less than 39 inches above the roadway surface and shall have an outside diameter of no less than 12.75 inches. A bollard system shall consist of a minimum of 3 bollards spaced no more than 48 inches from centerline to centerline of bollards across a 12 foot roadway. Bollards in the lowered position shall

be capable of supporting H 20 wheel load each. Design for this load shall be in accordance with AASHTO HB-16. Retractable bollards shall withstand a 15,000 pound vehicle at impact speed of 71 miles per hour, and a 30,000 pounds vehicle at a speed of 52 miles per hour, with maximum bollard deflection or vehicle penetration of 20 feet.

2.1.1.1 Powered Retractable Bollards

The retractable bollard shall be capable of 200 complete up/down cycles per hour. Bollards shall be capable of being raised or lowered within a 3 to 15-second range during normal use and within 1.5 seconds for emergency operations.

2.1.1.1.1 Failure Modes of Operation

The system shall be designed to prevent lowering of the barrier in the event of hydraulic, electrical, or mechanical failure. The accumulator shall be sized to allow three full cycle operations of a single Bollard in the even of a power outage. A manual pump shall be included for operation of hydraulic and/or mechanical barriers without power.

2.1.1.1.2 Electric Motors

Unless otherwise indicated, electric motors shall have totally enclosed enclosures.

2.1.1.1.3 System

The system shall be designed to maintain the barriers in the raised position, without inspection, for period of time of up to 1 week. If a hydraulic system is used, it shall be equipped with pressure relief valves to prevent overpressure.

2.1.1.1.4 Hydraulic Power Unit

The hydraulic power unit shall contain biodegradable and non-toxic hydraulic fluid which maintains its viscosity between 96 and 1000 saybolt universal seconds (SUS) even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F. Buried hydraulic lines for the connection of the hydraulic power unit to the barrier shall be flexible or carbon steel pipe, or a combination of flexible and carbon steel pipe. Flexible and rigid hydraulic line working pressure shall exceed the maximum system relief pressure.

- a. Flexible hydraulic lines shall be in accordance with SAE J 517.
- b. Rigid hydraulic lines shall be seamless carbon steel pipe in accordance with ASTM A 106.

2.1.1.1.5 Hydraulic Power Unit Enclosure

A NEMA Type 3R enclosure as specified in NEMA 250 shall be provided to enclose the hydraulic power unit. The enclosure shall be designed for easy removal of the hydraulic power unit and other accessories without complete removal of the enclosure. An access door with hinges and an inside and outside operable/lockable (exterior) door latch shall be provided. Equipment within the enclosure shall be placed and configured so that all periodic maintenance can be performed through the access door without removal of the equipment. The enclosure shall be equipped with

weatherproof louver vents appropriately sized and located to dissipate internal heat generation.

2.1.2 Manual Retractable Bollards

Manual bollards shall be capable of being raised and lowered utilizing a recessed handle on the top surface of the bollard, with a maximum force of 60 pounds or a manual hydraulic pump requiring a maximum 60 pounds of force. A recessed panel adjacent to the base of each bollard shall contain a spring actuated latching mechanism that automatically secures the bollard in either the full "UP" or full "DOWN" position. The panel shall have an access cover with provisions for a padlock to secure the access cover.

2.2 [Enter Appropriate Subpart Title Here]2.2.1 [Enter Appropriate Subpart Title Here]2.3 ELECTRICAL WORK

Motors, manual or automatic motor control equipment and protective or signal devices required for the operation specified herein shall be provided in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. All field wiring for loop detectors, communication lines, and power circuits shall have surge protection. Any wiring required for the operation specified herein, but not shown on the electrical plans, shall be provided under this section in accordance with Sections 16415A ELECTRICAL WORK, INTERIOR and 16375A ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

2.4 CONTROL PANEL

A control panel and control circuit shall be provided to interface between all barrier control stations and the power unit. The control station is defined as the main control panel. The control circuit shall contain all relays, timers, and other devices or an industrial programmable controller programmed as necessary for the barrier operation. The control panel shall allow direct interface with auxiliary equipment such as card readers, remote switches, loop detectors, infrared sensors, and gate limit switches.

The enclosure shall be as indicated on the drawings. All device interconnect lines shall be run to terminal strips.

2.4.1 Voltage

The control circuit shall operate from a 120 volt 60 Hz supply.

2.4.2 Main Control Panel

A main control panel shall be supplied to control barrier function. This panel shall have a key-lockable main switch with main power "ON" and panel "ON" lights. Buttons to raise and lower each set of barriers shall be provided. Barrier "UP" and "DOWN" indicator lights shall be included for each set of barriers. An emergency fast operate circuit (EFO) shall be operated from a push button larger than the normal controls and have a flip safety cover installed over the push button. The EFO shall also be furnished with an EFO-active light and reset button. The main control panel shall have a key lockable switch to arm or disable the remote control panel. An indicator light shall show if the remote control panel is enabled.

2.4.3 Remote Control Panel

A remote control panel shall have a panel "ON" light that is lit when enabled by a key lockable switch on the main control panel. Buttons to

raise and lower each barrier shall be provided. Barrier "UP" and "DOWN" indicator lights shall be included for each barrier. The EFO shall be operated from a push button larger than the normal controls and have a flip safety cover installed over the push button. The EFO shall be interconnected with an EFO-active light. When the remote control panel EFO is pushed, operation of the barrier will not be possible from this panel until reset at the main control panel.

2.5 MISCELLANEOUS EQUIPMENT

2.5.1 Safety Equipment

Red/yellow 8 inch traffic lights shall be supplied for each entrance and exit to alert motorists of the barrier position. Traffic lights are not required for manual barriers. The yellow light shall indicate that the barrier is fully open. All other positions shall cause the light to show red. Brackets shall be supplied to allow the light to be mounted a minimum 4.5 feet above the roadway pavement on a 3.5 inch outside diameter metal post or mounted directly on the crash gate.

2.5.2 [Enter Appropriate Subpart Title Here] 2.5.3 Signage

Signage shall read "Axle Weight Limit 9 Tons" and shall conform to FHWA SA-89-006 sign (R12.2).

2.5.4 Vertical Arm Gates (Traffic Arms)

Vertical arm gates shall have an opening and closing time of less than or equal to 15 seconds. The gates shall be capable of 15 duty cycles per hour as a minimum. Gate shall operate the arm through 90 degrees. Gate operators shall be supplied with single phase 120 volt motors. Each gate shall be capable of being operated from a remote open-close push button station. Gates shall have a hand-crank mechanism which will allow manual operation during power failures. Each gate shall be supplied with a handcrank. Gate arms shall be constructed out of wood, steel, fiberglass, or aluminum, as specified by the manufacturer for the given lengths as shown on the drawings. Gate arms shall be covered with 16 inch wide reflectorized red and white sheeting. Each gate shall be furnished with a spare gate arm. Gate operator cabinets shall be constructed of galvanized steel, or aluminum and shall be painted manufacturers standard color as approved. Each gate operator shall be provided with an obstruction detector that will automatically reverse the gate motor when an obstruction is detected. The obstruction detector shall be any of the following 3 types: An electronic loop vehicle detector buried in the road, a photocell electric eye mounted on the gate operator, or a safety strip mounted on the lower edge of the arm. The detector system shall be automatically deactivated when the arm reaches the fully lowered position. Slab size and anchorage for gate operator shall be per manufacturer requirements.

2.6 FINISH

Surfaces shall be painted in accordance with requirements of Section 09900 PAINTS AND COATINGS except for materials supplied with manufacturer's standard finish. The roadway plate shall have a nonskid surface. The barrier front shall have 6 inch wide reflective yellow stripes 4 inches apart. Bollards shall be painted reflective yellow with 3 inch wide black diagonal stripes.

2.7 CONCRETE

The concrete shall conform to Section 03307 CONCRETE FOR MINOR CONSTRUCTION.

2.8 WELDING

Welding shall be in accordance with AWS D1.1.

2.9 PAVEMENT

After placement of the vehicle barrier, the pavement sections shall be replaced to match the section and depth of the surrounding pavement. Pavement shall be warped to match the elevations of existing pavement. Positive surface drainage, away from the vehicle barrier, shall be provided by pavement slope.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with manufacturers instructions and in the presence of a representative of the manufacturer. Manufacturer's representative shall be experienced in the installation, adjustment, and operation of the equipment provided. The representative shall also be present during adjustment and testing of the equipment.

3.2 HYDRAULIC LINES

Buried hydraulic lines shall be placed in polyvinyl chloride (PVC) sleeves. Positive drainage shall be provided from the hydraulic power unit to the barrier for drainage of condensation within the PVC sleeve.

3.3 ELECTRICAL

All control power wiring requiring compression terminals shall use ring-style terminals. Terminals and compression tools shall conform to UL 486A. Roundhead screws and lockwashers shall be used to provide vibration-resistant connections. Connections between any printed circuit cards and the chassis shall be made with screw connections or other locking means to prevent shock or vibration separation of the card from its chassis. The electrical power supply breaker for the hydraulic power unit shall be capable of being locked in the power on and power off positions.

3.4 FIELD TESTING

Upon completion of construction, a field test shall be performed for each vehicle barrier. The test shall include raising and lowering the barrier, both electrically and manually, through its complete range of operation. Each vehicle barrier shall then be continuously cycled for not less than 30 minutes to test for heat build-up in the hydraulic system. The Contracting Officer shall be notified at least 7 days prior to the beginning of the field test. The Contractor shall furnish all equipment and make all necessary corrections and adjustments prior to tests witnessed by the Contracting Officer. Any conditions that interfere with the proper operation of the barrier disclosed by the test shall be corrected at no additional cost to the Government. Adjustments and repairs shall be done by the Contractor under the direction of the Contracting Officer. After adjustments are made to assure correct functioning of components, applicable tests shall be completed.

3.5 FIELD TRAINING

A field training course shall be provided for designated operating staff members. Training shall be provided for a total period of not less than [8 hours] [1 hour] of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance instructions.

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SECTION 03101A

FORMWORK FOR CONCRETE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 347R	(1994; R 1999) Guide to Formwork for Concrete
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31/C 31M	(2000) Making and Curing Concrete Test Specimens in the Field
ASTM C 39/C 39M	(1999) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 1074	(1998) Estimating Concrete Strength by the Maturity Method
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

U.S. DEPARTMENT OF COMMERCE (DOC)

PS-1	(1996) Voluntary Product Standard - Construction and Industrial Plywood
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1.2 DESIGN REQUIREMENTS

The design, engineering, and construction of the formwork shall be the responsibility of the Contractor. The formwork shall be designed for anticipated live and dead loads and shall comply with the tolerances specified in TABLE 1, paragraph FORM REMOVAL. The formwork shall be designed as a complete system with consideration given to the effects of cementitious materials and mixture additives such as fly ash, cement type, plasticizers, accelerators, retarders, air entrainment, and others. The adequacy of formwork design and construction shall be monitored prior to and during concrete placement as part of the Contractor's approved Quality Control Plan.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When

used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings; G

Drawings and design computations for all formwork required shall be submitted at least 30 days either before fabrication on site or before delivery of prefabricated forms. If reshoring is permitted, the method, including location, order, and time of erection and removal shall also be submitted for review.

SD-03 Product Data

Materials

Manufacturer's literature shall be submitted for plywood, concrete form hard board, form accessories, prefabricated forms, and form coating, and form-lining materials.

SD-06 Test Reports

Inspection

The Contractor shall submit field inspection reports for concrete forms and embedded items.

1.4 SHOP DRAWINGS

The shop drawings and data submitted shall include the type, size, quantity, and strength of all materials of which the forms are made, the plan for jointing of facing panels, details affecting the appearance, and the assumed design values and loading conditions.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Forms and Form Liners

Forms and form liners shall be fabricated with facing materials that will produce a finish meeting the specified irregularities in formed surface requirements as defined in ACI 347R. Forms and form liners shall be fabricated with facing materials as specified below.

2.1.1.1 Class "B" Finish

This class of finish shall apply to all surfaces except those specified to receive Class C or Class D. The form facing material shall be composed of tongue-and-groove or shiplap lumber, plywood conforming to PS-1, Grade B-B concrete form panels, Class I or II. Steel lining on wood sheathing will not be permitted. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels. Forms for round columns shall be the prefabricated seamless type.

2.1.1.2 Class "C" Finish

The form facing may be either tongue-and-groove lumber, plywood, concrete form hard board or steel. Wood form facing for curved or warped surfaces shall be composed of splines of lumber which can be bent to the required shape without splitting or cracking. Forms for round columns may have one vertical seam. Steel lining on wood sheathing shall not be used.

2.1.1.3 Class "D" Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

2.1.2 Form Coating

Form coating shall be commercial formulation that will not bond with, stain, cause deterioration, or any other damage to concrete surfaces. The coating shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

2.2 ACCESSORIES

Ties and other similar form accessories to be partially or wholly embedded in the concrete shall be of a commercially manufactured type. After the ends or end fasteners have been removed, the embedded portion of metal ties shall terminate not less than 2 inches from any concrete surface either exposed to view or exposed to water. Plastic snap ties may be used in locations where the surface will not be exposed to view. Form ties shall be constructed so that the ends or end fasteners can be removed without spalling the concrete.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Form Construction

Forms shall be constructed true to the structural design and required alignment. The form surface and joints shall be mortar tight and supported to achieve safe performance during construction, concrete placement, and form removal. The Contractor shall continuously monitor the alignment and stability of the forms during all phases to assure the finished product will meet the required surface class specified in paragraph FORMS AND FORM LINERS and tolerances specified in paragraph DESIGN REQUIREMENTS. Failure of any supporting surface either due to surface texture, deflection or form collapse shall be the responsibility of the Contractor as will the replacement or correction of unsatisfactory surfaces. When forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be re-used if there is any evidence of defects which would impair the quality of the resulting concrete surface. All surfaces of used forms shall be cleaned of mortar and any other foreign material before reuse.

3.1.2 Chamfering

All exposed joints, edges and external corners shall be chamfered by molding placed in the forms unless the drawings specifically state that

chamfering is to be omitted or as otherwise specified. Chamfered joints shall not be permitted where earth or rockfill is placed in contact with concrete surfaces. Chamfered joints shall be terminated twelve inches outside the limit of the earth or rockfill so that the end of the chamfers will be clearly visible.

3.1.3 Coating

Forms for exposed or painted surfaces shall be coated with form oil or a form-release agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's instructions. Forms for unexposed surfaces may be wet with water in lieu of coating immediately before placing concrete, except that, in cold weather when freezing temperatures are anticipated, coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.2 FORM REMOVAL

Forms shall not be removed without approval. The minimal time required for concrete to reach a strength adequate for removal of formwork without risking the safety of workers or the quality of the concrete depends on a number of factors including, but not limited to, ambient temperature, concrete lift heights, type and amount of concrete admixture, and type and amount of cementitious material in the concrete. It is the responsibility of the Contractor to consider all applicable factors and leave the forms in place until it is safe to remove them. In any case forms shall not be removed unless the minimum time, minimum ambient temperature, and minimum compressive strength requirements below are met, except as otherwise directed or specifically authorized. When conditions are such as to justify the requirement, forms will be required to remain in place for a longer period. All removal shall be accomplished in a manner which will prevent damage to the concrete and ensure the complete safety of the structure. Where forms support more than one element, the forms shall not be removed until the form removal criteria are met by all supported elements. Evidence that concrete has gained sufficient strength to permit removal of forms shall be determined by tests on control cylinders. All control cylinders shall be stored in the structure or as near the structure as possible so they receive the same curing conditions and protection methods as given those portions of the structure they represent. Control cylinders shall be removed from the molds at an age of no more than 24 hours. All control cylinders shall be prepared and tested in accordance with ASTM C 31/C 31M and ASTM C 39/C 39M at the expense of the Contractor by an independent laboratory that complies with ASTM C 1077 and shall be tested within 4 hours after removal from the site.

TABLE 1:

TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:	In any 10 feet of length ----- 1/4 inch
a. In the lines and surfaces of columns, piers, and walls	Maximum for entire length ----- 1 inch
b. For exposed corner columns, control-joint grooves, and	In any 20 feet of length ----- 1/4 inch Maximum for entire length ---- 1/2 inch

TABLE 1:

TOLERANCES FOR FORMED SURFACES

other conspicuous lines	
2. Variation from the level or from the grades indicated on the drawings:	In any 10 feet of length ----- 1/4 inch In any bay or in any 20 feet of length -----
3/8 inch	
a. In slab soffits, ceilings, beam soffits, and in arises, supporting shores	Maximum for entire length ---- 3/4 inch measured before removal of
b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	In any bay or in any 20 feet of length ----- 1/4 inch Maximum for entire length ---- 1/2 inch
3. Variation of the linear building lines from established position in plan	In any 20 feet ----- 1/2 inch Maximum ----- 1 inch
4. Variation of distance between walls, columns, partitions	1/4 inch per 10 feet of distance, but not more than 1/2 inch in any one bay, and not more than 1 inch total variation
5. Variation in the sizes and locations of sleeves, floor openings, and wall opening	Minus ----- 1/4 inch Plus ----- 1/2 inch
6. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls	Minus ----- 1/4 inch Plus ----- 1/2 inch
7. Footings:	
a. Variation of dimensions in plan	Minus ----- 1/2 inch Plus ----- 2 inches when formed or plus 3 inches when placed against unformed excavation
b. Misplacement of 2 percent of the footing width in the eccentricity direction of misplacement but not more than	----- 2 inches
c. Reduction in thickness	Minus ----- 5 percent of specified thickness
8. Variation in steps:	Riser ----- 1/8 inch
a. In a flight of stairs	Tread ----- 1/4 inch
b. In consecutive steps	Riser ----- 1/16 inch

TABLE 1:TOLERANCES FOR FORMED SURFACES

Tread ----- 1/8 inch

3.2.1 Formwork Not Supporting Weight of Concrete

Formwork for walls, columns, sides of beams, gravity structures, and other vertical type formwork not supporting the weight of concrete shall not be removed in less than 24 hours after concrete placement is completed. Form removal before 24 hours will be allowed for simple floor slab, sidewalks, and driveways provided the ambient temperature during this period has not fallen below 50 degrees F at any time since placement and evidence from compressive tests on field-cured concrete control cylinders indicate that the concrete has attained a compressive strength of at least 500 psi. Control cylinders shall be prepared for each set of forms to be removed before 24 hours.

3.3 INSPECTION

Forms and embedded items shall be inspected in sufficient time prior to each concrete placement by the Contractor in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

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SECTION 03200A
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318/318R	(1995) Building Code Requirements for Structural Concrete and Commentary
ACI 318M/318RM	(1999) Building Code Requirements for Structural Concrete and Commentary (Metric)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1999) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 82	(1997a) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 184/A 184M	(1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	(1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 496	(1997) Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497	(1997) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615/A 615M	(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 675/A 675M	(1990a; R 1995e1) Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A 706/A 706M	(1998) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 767/A 767M	(1997) Zinc-Coated (Galvanized) Steel Bars in Concrete Reinforcement

ASTM A 775/A 775M (1997e1) Epoxy-Coated Reinforcement Steel Bars

ASTM A 884/A 884M (1996ae1) Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4 (1998) Structural Welding Code - Reinforcing Steel

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI MSP-1 (1996) Manual of Standard Practice

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Reinforcement; G

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

SD-03 Product Data

Welding

A list of qualified welders names.

SD-07 Certificates

Reinforcing Steel

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

1.3 WELDING

Welders shall be qualified in accordance with AWS D1.4. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4.

1.4 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 DOWELS

Dowels shall conform to ASTM A 675/A 675M, Grade 80. Steel pipe conforming to ASTM A 53, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184/A 184M.

2.3 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82. In highly corrosive environments or when directed by the Contracting Officer, reinforcing steel shall conform to ASTM A 767/A 767M or ASTM A 775/A 775M as appropriate.

2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185. When directed by the Contracting Officer for special applications, welded wire fabric shall conform to ASTM A 884/A 884M.

2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318/318R. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318/318R at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318/318R. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318/318R and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

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SECTION 03307A

CONCRETE FOR MINOR STRUCTURES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 308	(1992; R 1997) Standard Practice for Curing Concrete
ACI 318/318R	(1999) Building Code Requirements for Structural Concrete and Commentary
ACI 318M	(1995) Metric Building Code Requirements for Structural Concrete and Commentary
ACI 347R	(1994; R 1999) Guide to Formwork for Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	(1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615/A 615M	(2000) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 143/C 143M	(2000) Slump of Hydraulic Cement Concrete
ASTM C 150	(1999a) Portland Cement
ASTM C 171	(1997a) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2000) Air-Entraining Admixtures for Concrete
ASTM C 309	(1998a) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	(2000e1) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1999ae1) Concrete Aggregates

ASTM C 39/C 39M	(2001) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 595	(2000a) Blended Hydraulic Cements
ASTM C 595M	(1997) Blended Hydraulic Cements (Metric)
ASTM C 618	(2000) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 685	(2000) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C 920	(1998) Elastomeric Joint Sealants
ASTM C 94/C 94M	(2000e2) Ready-Mixed Concrete
ASTM D 1752	(1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 98	(1998) Calcium Chloride
ASTM E 96	(2000) Water Vapor Transmission of Materials

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Air-Entraining Admixture; G
 Accelerating Admixture; G
 Water-Reducing or Retarding Admixture; G
 Curing Materials; G
 Expansion Joint Filler Strips, Premolded; G
 Joint Sealants - Field Molded Sealants; G

Manufacturer's literature is available from suppliers which demonstrates compliance with applicable specifications for the above materials.

Batching and Mixing Equipment; G

Batching and mixing equipment will be accepted on the basis of manufacturer's data which demonstrates compliance with the applicable specifications.

Conveying and Placing Concrete; G

The methods and equipment for transporting, handling, depositing, and consolidating the concrete shall be submitted prior to the first concrete placement.

Color Samples; G

2 Color Sample boards of integrally colored concrete shall be submitted to the Contracting Officer for color selection.

SD-06 Test Reports

Aggregates; G

Aggregates will be accepted on the basis of certificates of compliance and test reports that show the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

Concrete Mixture Proportions; G

Ten days prior to placement of concrete, the contractor shall submit the mixture proportions that will produce concrete of the quality required. Applicable test reports shall be submitted to verify that the concrete mixture proportions selected will produce concrete of the quality specified.

SD-07 Certificates

Cementitious Materials; G

Certificates of compliance attesting that the concrete materials meet the requirements of the specifications shall be submitted in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Cementitious material will be accepted on the basis of a manufacturer's certificate of compliance, accompanied by mill test reports that the material(s) meet the requirements of the specification under which it is furnished.

Aggregates; G

Aggregates will be accepted on the basis of certificates of compliance and tests reports that show the material(s) meet the quality and grading requirements of the specifications under which it is furnished.

1.3 DESIGN AND PERFORMANCE REQUIREMENTS

The Government will maintain the option to sample and test joint sealer, joint filler material, aggregates and concrete to determine compliance with the specifications. The Contractor shall provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Concrete will be sampled in

accordance with ASTM C 172. Slump and air content will be determined in accordance with ASTM C 143/C 143M and ASTM C 231, respectively, when cylinders are molded. Compression test specimens will be made, cured, and transported in accordance with ASTM C 31/C 31M. Compression test specimens will be tested in accordance with ASTM C 39/C 39M. Samples for strength tests will be taken not less than once each shift in which concrete is produced. A minimum of three specimens will be made from each sample; two will be tested at 28 days (90 days if pozzolan is used) for acceptance, and one will be tested at 7 days for information.

1.3.1 Strength

Acceptance test results will be the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete will be considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f'_c , and no individual acceptance test result falls below f'_c by more than 500 psi.

1.3.2 Construction Tolerances

A Class "C" finish shall apply to all surfaces except those specified to receive a Class "D" finish. A Class "D" finish shall apply to all surfaces which will be permanently concealed after construction. The surface requirements for the classes of finish required shall be as specified in ACI 347R.

1.3.3 Concrete Mixture Proportions

Concrete mixture proportions shall be the responsibility of the Contractor.

Mixture proportions shall include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per cubic yard of concrete. All materials included in the mixture proportions shall be of the same type and from the same source as will be used on the project. Specified compressive strength f'_c shall be 3,000 psi at 28 days (90 days if pozzolan is used). The maximum nominal size coarse aggregate shall be 3/4-inch, in accordance with ACI 318/318R. The air content shall be between 3 and 5 percent. The slump shall be between 1 and 3 inches. The maximum water cement ratio shall be 0.50.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Cementitious Materials

Cementitious materials shall conform to the appropriate specifications listed:

2.1.1.1 Portland Cement

ASTM C 150, Type II, low alkali.

2.1.1.2 Blended Hydraulic Cement

ASTM C 595, Type IP, low alkali.

2.1.1.3 Pozzolan

Pozzolan shall conform to ASTM C 618, Class F, including requirements of Tables 1A and 2A. Loss on ignition shall not exceed 3 percent. Supplementary optional chemical requirements shall apply.

2.1.2 Aggregates

Aggregates shall meet the quality and grading requirements of ASTM C 33 Class Designations. Grading requirement for coarse aggregate shall conform to size number 4 and 67, when combined, meet the requirements of ASTM C 33, size 467. The maximum nominal aggregate size shall be 3/4-inch. For concrete requiring larger than 1-inch maximum size aggregate, the coarse aggregate shall be provided in two or more fractional sizes and used in concrete in the proportions that will produce a combined coarse aggregate gradation within the appropriate range specified in ASTM C 33

2.1.3 Admixtures

Admixtures to be used, when required or approved, shall comply with the appropriate specification listed. Chemical admixtures that have been in storage at the project site for longer than 6 months or that have been subjected to freezing shall be retested at the expense of the contractor at the request of the Contracting Officer and shall be rejected if test results are not satisfactory.

2.1.3.1 Air-Entraining Admixture

Air-entraining admixture shall meet the requirements of ASTM C 260.

2.1.3.2 Accelerating Admixture

Accelerators shall meet the requirements of ASTM C 494/C 494M, Type C or E.

2.1.3.3 Water-Reducing or Retarding Admixture

Water-reducing or retarding admixture shall meet the requirements of ASTM C 494/C 494M, Type A, B, or D. High-range water reducing admixture Type F or G may be used only when approved, approval being contingent upon particular placement requirements as described in the Contractor's Quality Control Plan. Type G admixture shall not be used for slabs-on-grade.

2.1.4 Water

Water for mixing and curing shall be fresh, clean, potable, and free from injurious amounts of oil, acid, salt, or alkali, except that unpotable water may be used if it meets the requirements of COE CRD-C 400.

2.1.5 Expansion Joint Filler Strips, Premolded

Expansion joint filler strips, premolded shall be sponge rubber conforming to ASTM D 1752, Type I.

2.1.6 Joint Sealants - Field Molded Sealants

Joint sealants - field molded sealants shall conform to ASTM C 920, Type M, Grade NS, Class 25, use NT for vertical joints and Type M, Grade P, Class 25, use T for horizontal joints. Bond-breaker material shall be polyethylene tape, coated paper, metal foil, or similar type materials.

The backup material shall be compressible, nonshrink, nonreactive with the sealant, and a nonabsorptive material such as extruded butyl or polychloroprene foam rubber. Immediately prior to installation of field-molded sealants, the joint shall be cleaned of all debris and further cleaned using water, chemical solvents, or other means as recommended by the sealant manufacturer or directed.

2.1.7 Vapor Barrier

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 20 mils or other equivalent material having a vapor permeance rating not exceeding 0.5 perms as determined in accordance with ASTM E 96.

2.1.8 Curing Materials

Curing materials shall conform to the following requirements.

2.1.8.1 Impervious Sheet Materials

Impervious sheet materials, ASTM C 171, type optional, except polyethylene film, if used, shall be white opaque.

2.1.8.2 Membrane-Forming Curing Compound

ASTM C 309, Type 1-D, Class A or B.

2.1.8.3 Burlap

FS CCG-C-467.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 General

Construction joints shall be prepared to expose coarse aggregate, and the surface shall be clean, damp, and free of laitance. Ramps and walkways, as necessary, shall be constructed to allow safe and expeditious access for concrete and workmen. Snow, ice, standing or flowing water, loose particles, debris, and foreign matter shall have been removed. Earth foundations shall be satisfactorily compacted. Spare vibrators shall be available. The entire preparation shall be accepted by the Government prior to placing.

3.1.2 Embedded Items

Reinforcement shall be secured in place; joints, anchors, and other embedded items shall have been positioned. Internal ties shall be arranged so that when the forms are removed the metal part of the tie will be not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Embedded items shall be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. All equipment needed to place, consolidate, protect, and cure the concrete shall be at the placement site and in good operating condition. Voids in sleeves, slots and inserts shall be filled with readily removable material to prevent the entry of concrete.

3.1.3 Formwork Installation

Forms shall be properly aligned, adequately supported, and mortar-tight. The form surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed faces. All exposed joints and edges shall be chamfered, unless otherwise indicated.

3.1.4 Vapor Barrier Installation

Vapor barriers shall be applied as shown on the Contract Drawings. Edges shall be lapped not less than 6 inches. All joints and riser openings shall be sealed with pressure-sensitive adhesive not less than 2 inches wide. The vapor barrier shall be protected at all times to prevent injury or displacement prior to and during sand cushion, steel, and concrete placement.

3.1.5 Production of Concrete

3.1.5.1 Ready-Mixed Concrete

Ready-mixed concrete shall conform to ASTM C 94/C 94M except as otherwise specified.

3.1.5.2 Concrete Made by Volumetric Batching and Continuous Mixing

Concrete made by volumetric batching and continuous mixing shall conform to ASTM C 685.

3.1.5.3 Batching and Mixing Equipment

The contractor shall have the option of using an on-site batching and mixing facility. The facility shall provide sufficient batching and mixing equipment capacity to prevent cold joints. The method of measuring materials, batching operation, and mixer shall be submitted for review.

3.2 CONVEYING AND PLACING CONCRETE

Conveying and placing concrete shall conform to the following requirements.

3.2.1 General

Concrete placement shall not be permitted when weather conditions prevent proper placement and consolidation without approval. When concrete is mixed and/or transported by a truck mixer, the concrete shall be delivered to the site of the work and discharge shall be completed within 1-1/2 hours or 45 minutes when the placing temperature is 85 degrees F or greater unless a retarding admixture is used. Concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods which prevent segregation or loss of ingredients. Concrete shall be in place and consolidated within 15 minutes after discharge from the mixer. Concrete shall be deposited as close as possible to its final position in the forms and be so regulated that it may be effectively consolidated in horizontal layers 18 inches or less in thickness with a minimum of lateral movement. The placement shall be carried on at such a rate that the formation of cold joints will be prevented.

3.2.2 Consolidation

Each layer of concrete shall be consolidated by rodding, spading, or

internal vibrating equipment. Internal vibration shall be systematically accomplished by inserting the vibrator through the fresh concrete in the layer below at a uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator and overlay the adjacent, just-vibrated area by a few inches. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the layer below, if such a layer exists. It shall be held stationary until the concrete is consolidated and then withdrawn slowly at the rate of about 3 inches per second. Slabs 4 inches and less shall be consolidated by properly designated vibrating screeds or other approved technique and not by internal vibration.

3.2.3 Cold-Weather Requirements

No concrete placement shall be made when the ambient temperature is below 35 degrees F or if the ambient temperature is below 40 degrees F and falling. Suitable covering and other means as approved shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing and at a temperature above freezing for the remainder of the curing period. Salt, chemicals, or other foreign materials shall not be mixed with the concrete to prevent freezing. Any concrete damaged by freezing shall be removed and replaced at the expense of the contractor.

3.2.4 Warm-Weather Requirements

When the rate of evaporation of surface moisture, as determined by use of Figure 1 of ACI 308, is expected to exceed 0.2 pound per square foot per hour, provisions for windbreaks, shading, fog spraying, or covering with a light-colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as finishing operations will allow.

The temperature of the concrete placed during warm weather shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 95 degrees F.

3.3 FINISHING

3.3.1 General

No finishing or repair will be done when either the concrete or the ambient temperature is below 50 degrees F.

3.3.2 Finishing Formed Surfaces

All fins and loose materials shall be removed, and surface defects including tie holes shall be filled. All honeycomb areas and other defects shall be repaired. All unsound concrete shall be removed from areas to be repaired. Surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete shall be reamed or chipped and filled with dry-pack mortar. The prepared area shall be brush-coated with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filled with mortar or concrete. The cement used in mortar or concrete for repairs to all surfaces permanently exposed to view shall be a blend of portland cement and white cement so that the final color when cured will be the same as

adjacent concrete.

3.3.3 Finishing Unformed Surfaces

All unformed surfaces that are not to be covered by additional concrete or backfill shall be float finished to elevations shown, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left as a true and regular surface. Exterior surfaces shall be sloped for drainage unless otherwise shown. Joints shall be carefully made with a jointing tool. Unformed surfaces shall be finished to a tolerance of 3/8 inch for a float finish and 5/16 inch for a trowel finish as determined by a 10 foot straightedge placed on surfaces shown on the plans to be level or having a constant slope. Finishing shall not be performed while there is excess moisture or bleeding water on the surface. No water or cement shall be added to the surface during finishing.

3.3.3.1 Float Finish

Slabs to receive a steel trowel finish shall be given a float finish. Surfaces to be float finished shall be screeded and darried or bullfloated to eliminate the ridges and to fill in the voids left by the screed. In addition, the darby or bullfloat shall fill all surface voids and only slightly embed the coarse aggregate below the surface of the fresh concrete. When the water sheen disappears and the concrete will support a person's weight without deep imprint, floating should be completed. Floating should embed large aggregates just beneath the surface, remove slight imperfections, humps, and voids to produce a plane surface, compact the concrete, and consolidate mortar at the surface.

3.3.3.2 Trowel Finish

A trowel finish will be specified for most wearing surfaces and where a smooth finish is required. Slabs shall be given a trowel finish immediately following floating to provide a smooth, even, dense finish free from blemishes including trowel marks. Finished surfaces shall be protected from damage during the construction period.

3.3.3.3 Broom Finish

A broom finish shall be applied to indicated areas. The concrete shall be screeded and floated to required finish plane with no coarse aggregate visible. After surface moisture disappears, the surface shall be broomed or brushed with a broom or fiber bristle brush in a direction transverse to that of the main traffic or as directed.

3.3.3.4 Expansion and Contraction Joints

Expansion and contraction joints shall be made in accordance with the details shown or as otherwise specified. Provide 1/2 inch thick transverse expansion joints where new work abuts an existing concrete. Expansion joints shall be provided at a maximum spacing of 30 feet on center in sidewalks and at a maximum spacing as indicated in slabs, unless otherwise indicated. Contraction joints shall be provided at the spacing shown for sidewalks and slabs, unless otherwise indicated. Contraction joints shall be cut with a jointing tool after the surface has been finished. The depth of the contraction joints shall be 1/4 the thickness of the slab.

3.4 CURING AND PROTECTION

Beginning immediately after placement and continuing for at least 7 days, all concrete shall be cured and protected from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage, and exposure to rain or flowing water. All materials and equipment needed for adequate curing and protection shall be available and at the site of the placement prior to the start of concrete placement. Preservation of moisture for concrete surfaces not in contact with forms shall be accomplished by one of the following methods:

- a. Continuous sprinkling or ponding.
- b. Application of absorptive mats or fabrics kept continuously wet.
- c. Application of sand kept continuously wet.
- d. Application of impervious sheet material conforming to ASTM C 171.
- e. Application of membrane-forming curing compound conforming to ASTM C 309, Type 1-D, on surfaces permanently exposed to view and Type 2 on other surfaces shall be accomplished in accordance with manufacturer's instructions.

The preservation of moisture for concrete surfaces placed against wooden forms shall be accomplished by keeping the forms continuously wet for 7 days. If forms are removed prior to end of the required curing period, other curing methods shall be used for the balance of the curing period. During the period of protection removal, the temperature of the air in contact with the concrete shall not be allowed to drop more than 25 degrees F within a 24 hour period.

3.5 TESTS AND INSPECTIONS

3.5.1 General

The individuals who sample and test concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.5.2 Inspection Details and Frequency of Testing

3.5.2.1 Preparations for Placing

Foundation or construction joints, forms, and embedded items shall be inspected in sufficient time prior to each concrete placement by the Contractor to certify that it is ready to receive concrete.

3.5.2.2 Air Content

Air content shall be checked at least once during each shift that concrete is placed. Samples shall be obtained in accordance with ASTM C 172 and tested in accordance with ASTM C 231.

3.5.2.3 Slump

Slump shall be checked twice during each shift that concrete is produced. Samples shall be obtained in accordance with ASTM C 172 and tested in accordance with ASTM C 143/C 143M.

3.5.2.4 Consolidation and Protection

The Contractor shall ensure that the concrete is properly consolidated, finished, protected, and cured.

3.5.3 Action Required

3.5.3.1 Placing

The placing foreman shall not permit placing to begin until he has verified that an adequate number of acceptable vibrators, which are in working order and have competent operators, are available. Placing shall not be continued if any pile is inadequately consolidated.

3.5.3.2 Air Content

Whenever a test result is outside the specification limits, the concrete shall not be delivered to the forms and an adjustment shall be made to the dosage of the air-entrainment admixture.

3.5.3.3 Slump

Whenever a test result is outside the specification limits, the concrete shall not be delivered to the forms and an adjustment should be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the water-cement ratio does not exceed that specified in the submitted concrete mixture proportion.

3.5.4 Reports

The results of all tests and inspections conducted at the project site shall be reported informally at the end of each shift and in writing weekly and shall be delivered within 3 days after the end of each weekly reporting period.

-- End of Section --

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SECTION 04200

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SECTION 04200

MASONRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 530.1	(1999) Specifications for Masonry Structures and Related Commentaries
ACI 318/318M	(2002) Building Code Requirements for Structural Concrete and Commentary
ACI SP-66	(1994) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 616/A 616M	(1996a) Rail Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM C 67	(2002) Sampling and Testing Brick and Structural Clay Tile
ASTM C 90	(2002) Loadbearing Concrete Masonry Units
ASTM C 91	(2001) Masonry Cement
ASTM C 94/C 94M	(2000e2) Ready-Mixed Concrete
ASTM C 129	(2001) Nonloadbearing Concrete Masonry

Units

ASTM C 140	(2001a ¹) Sampling and Testing Concrete Masonry Units and Related Units
ASTM C 144	(1999) Aggregate for Masonry Mortar
ASTM C 150	(2002) Portland Cement
ASTM C 270	(2001a) Mortar for Unit Masonry
ASTM C 476	(2001) Grout for Masonry
ASTM C 494/C 494M	(1999a ¹) Chemical Admixtures for Concrete
ASTM C 641	(1998e ¹) Staining Materials in Lightweight Concrete Aggregates
ASTM C 744	(1999) Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C 780	(2000) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 1019	(2000b) Sampling and Testing Grout
ASTM C 1072	(2000a) Measurement of Masonry Flexural Bond Strength
ASTM C 1142	(1995; R 2001) Extended Life Mortar for Unit Masonry
ASTM D 2000	(2001) Rubber Products in Automotive Applications
ASTM D 2240	(2002) Rubber Property - Durometer Hardness
ASTM D 2287	(1996; R 2001) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E 119	(2000a) Fire Tests of Building Construction and Materials
ASTM E 447	(1997) Compressive Strength of Masonry Prisms

ASTM E 514

(1990; R 1996e1) Water Penetration and
Leakage Through Masonry

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Masonry Work; G, RE

Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; lintels; and wall openings. Bar splice locations shall be shown. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1/4 inch per foot. Reinforcement bending details shall conform to the requirements of ACI SP-66.

SD-03 Product Data

Manufacturer's descriptive data.

Cold Weather Installation; G, ED

Cold weather construction procedures.

SD-04 Samples

Concrete Masonry Units (CMU); G, RE

Color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture. Submit sample of colored mortar with applicable masonry unit.

Anchors, and Bar Positioners;

Two of each type used.

Expansion-Joint Materials;

One piece of each type used.

Portable Panel; G, RE

SD-05 Design Data

Pre-mixed Mortar;

Unit Strength Method;

Pre-mixed mortar composition. Calculations and certifications of masonry unit and mortar strength.

SD-06 Test Reports

Efflorescence Test; G, RE

Field Testing of Mortar; G, RE

Field Testing of Grout; G, RE

Prism tests; G, RE

Masonry Cement; G, RE

Fire-rated CMU; G, RE

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

Special Inspection; G, RE

Copies of masonry inspector reports.

SD-07 Certificates

Concrete Masonry Units (CMU);

Control Joint Keys;

Anchors and Bar Positioners;

Expansion-Joint Materials;

Reinforcing Steel Bars and Rods;

Masonry Cement;

Mortar Coloring;

Admixtures for Masonry Mortar;

Admixtures for Grout;

Certificates of compliance stating that the materials meet the specified requirements.

SD-08 Manufacturer's Instructions

1.3 SAMPLE MASONRY PANELS

After material samples are approved and prior to starting masonry work, a portable panel sample masonry panels shall be constructed for each type and color of masonry required. At least 48 hours prior to constructing the sample panel or panels, the Contractor shall submit written notification to the Contracting Officer's Representative. Sample panels shall not be built in, or as part of the structure, but shall be located where directed.

1.3.1 Configuration

Panels shall be L-shaped or otherwise configured to represent all of the wall elements. Panels shall be of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. The minimum size of a straight panel or a leg of an L-shaped panel shall be 8 feet long by 6 feet high.

1.3.2 Composition

Panels shall show full color range, texture, and bond pattern of the masonry work. The Contractor's method for mortar joint tooling; grouting of reinforced vertical cores, collar joints, bond beams, and lintels; positioning, securing, and lapping of reinforcing steel; and cleaning of masonry work shall be demonstrated during the construction of the panels. Installation or application procedures for anchors, wall ties, CMU control joints, shall be shown in the sample panels. The panels shall contain a masonry bonded corner that includes a bond beam corner. Panels shall show parging and installation of electrical boxes and conduit. Panels that represent reinforced masonry shall contain a 2 by 2 foot opening placed at least 2 feet above the panel base and 2 feet away from all free edges, corners, and control joints. Required reinforcing shall be provided around this opening as well as at wall corners and control joints.

1.3.3 Construction Method

Where masonry is to be grouted, the Contractor shall demonstrate and receive approval on the method that will be used to bring up the masonry wythes; support the reinforcing bars; and grout cells, bond beams, lintels, and collar joints using the requirements specified herein. If sealer is specified to be applied to the masonry units, sealer shall be applied to the sample panels. Panels shall be built on a properly designed concrete foundation.

1.3.4 Usage

The completed panels shall be used as the standard of workmanship for the type of masonry represented. Masonry work shall not commence until the sample panel for that type of masonry construction has been completed and approved. Panels shall be protected from the weather and construction operations until the masonry work has been completed and approved. After completion of the work, the sample panels, including all foundation concrete, shall become the property of the Contractor and shall be removed from the construction site.

1.4 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid

chipping, breakage, and contact with soil or contaminating material.

1.4.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather. Store Type II, concrete masonry units at the site for a minimum of 28 days for air cured units, 10 days for atmospheric steam or water cured units, and 3 days for units cured with steam at a pressure of 120 to 150 psi and at a temperature of 350 to 365 degrees F for at least 5 hours.

Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.4.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.4.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

1.5 STRUCTURAL MASONRY

1.5.1 Special Inspection

A qualified masonry inspector approved by the Contracting Officer shall perform inspection of the masonry work. Minimum qualifications for the masonry inspector shall be 5 years of reinforced masonry inspection experience or acceptance by a State, municipality, or other governmental body having a program of examining and certifying inspectors for reinforced masonry construction. The masonry inspector shall be present during preparation of masonry prisms, sampling and placing of masonry units, placement of reinforcement (including placement of dowels in footings and foundation walls), inspection of grout space, immediately prior to closing of cleanouts, and during grouting operations. The masonry inspector shall assure Contractor compliance with the drawings and specifications. The masonry inspector shall keep a complete record of all inspections and shall submit daily written reports to the Quality Control Supervisory Representative reporting the quality of masonry construction.

1.6 QUALITY ASSURANCE

1.6.1 Testing

Masonry strength shall be determined in accordance with ACI 530.1; submit test reports on three prisms in accordance with ASTM E 447, Method B modified as specified in ACI 530.1. The cost of testing shall be paid by the Contractor.

1.6.2 Spare Vibrator

Maintain at least one spare vibrator on site at all times.

1.6.3 Bracing and Scaffolding

Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by local code.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval. 2.2 CONCRETE MASONRY UNITS (CMU)

Cement shall have a low alkali content and be of one brand. Units shall be of modular dimensions and air, water, or steam cured. Exposed surfaces of units shall be smooth and of uniform texture. Exterior concrete masonry units shall have water-repellant admixture added during manufacture.

- a. Hollow Load-Bearing Units: ASTM C 90, Type I or II, made with medium weight aggregate. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.
- b. Hollow Non-Load-Bearing Units: ASTM C 129, Type I or II, made with medium weight aggregate. Load-bearing units may be provided in lieu of non-load-bearing units.

2.2.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

2.2.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 1 inch. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

2.2.2.1 Architectural Units

Units shall be integrally colored during manufacture. Color shall be as indicated on the drawings.

2.2.3 Fire-Rated CMU

Concrete masonry units used in fire-rated construction shown on the drawings shall be of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated on the aggregate requiring the greater minimum equivalent thickness

to produce the required fire rating. Construction shall conform to ASTM E 119.

TABLE I
FIRE-RATED CONCRETE MASONRY UNITS

See note (a) below

Aggregate Type	Minimum equivalent thickness inches for fire rating of:		
	4 hours	3 hours	2 hours
Pumice	4.7	4.0	3.0
Expanded slag	5.0	4.2	3.3
Expanded clay, shale, or slate	5.7	4.8	3.7
Limestone, scoria, cinders or unexpanded slag	5.9	5.0	4.0
Calcareous gravel	6.2	5.3	4.2
Siliceous gravel	6.7	5.7	4.5

(a) Minimum equivalent thickness shall equal net volume as determined in conformance with ASTM C 140 divided by the product of the actual length and height of the face shell of the unit in inches.

2.3 PRECAST CONCRETE ITEMS

Trim, lintels, copings, splashblocks and door sills shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 3000 psi minimum conforming to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE using 1/2 inch to No. 4 nominal-size coarse aggregate, and minimum reinforcement shall be the reinforcement required for handling of the units. Clearance of 3/4 inch shall be maintained between reinforcement and faces of units. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 120 psi for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or steam-cured and shall then be aged under cover for 28 days or longer. Cast-concrete members weighing over 80 pounds shall have built-in loops of galvanized wire or other approved provisions for lifting and anchoring. Units shall have beds and joints at right angles to the face, with sharp true arises and shall be cast with drip grooves on the underside where units overhang walls. Exposed-to-view surfaces shall be free of surface voids, spalls, cracks, and chipped or broken edges. Precast units exposed-to-view shall be of uniform appearance and color. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

2.3.1 Lintels

Precast lintels, unless otherwise shown, shall be of a thickness equal to the wall and reinforced with two No. 4 bars for the full length. Top of lintels shall be labeled "TOP" or otherwise identified and each lintel shall be clearly marked to show location in the structure. In reinforced masonry, lintels shall conform to ACI 318/318M for flexural and shear strength and shall have at least 8 inches bearing at each end. Concrete shall have a minimum 28 day compressive strength of 3000psi using 1/2 inch to No. 4 nominal-size coarse aggregate. Reinforcement shall conform to ASTM A 615/A 615M Grade 60. Limit lintel deflection due to dead plus live load to $L/600$ or 0.3 inches. Provide top and bottom bars for lintels over 36 inches in length.

2.3.2 Sills and Copings

Sills and copings shall be cast with washes. Sills for windows having mullions shall be cast in sections with head joints at mullions and a 1/4 inch allowance for mortar joints. The ends of sills, except a 3/4 inch wide margin at exposed surfaces, shall be roughened for bond. Treads of door sills shall have rounded nosings. Reinforce sills with not less than two No. 4 bars.

2.3.3 Splash Blocks

Splash blocks shall be as detailed. Reinforcement shall be the manufacturer's standard.

2.4 MORTAR FOR STRUCTURAL MASONRY

ASTM C 270, Type S. Strength ($f'm$) as indicated. Test in accordance with ASTM C 780. Use Type I portland cement. Do not use admixtures containing chlorides. When structural reinforcement is incorporated, maximum air-content shall be 12 percent in cement-lime mortar and 18 percent in masonry cement mortar.

2.5 MASONRY MORTAR

Mortar Type S shall conform to the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate. Type S mortar shall be used for all CMU work. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.5.1 Admixtures for Masonry Mortar

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C.

2.5.2 Colored Mortar

Mortar coloring shall be added to the mortar used for exposed masonry surfaces to produce a uniform color as indicated on the drawings.. Quantity of pigment to cementitious content of the masonry cement shall not exceed 5percent by weight; carbon black shall not exceed 1 percent by

weight. Quantity of pigment to cementitious content of cement-lime mix shall not exceed 10 percent by weight, carbon black no more than 2 percent by weight. Mortar coloring shall be chemically inert, of finely ground limeproof pigment, and furnished in accurately pre-measured and packaged units that can be added to a measured amount of cement. Compressive strength of colored mortar shall equal 1800 psi.

2.5.3 Cement

Portland cement shall conform to ASTM C 150, Type I. Masonry cement shall conform to ASTM C 91, Type S. Containers shall bear complete instructions for proportioning and mixing to obtain the required types of mortar.

2.5.4 Pre-Mixed Mortar

Pre-mixed mortar shall conform to ASTM C 1142, Type RS.

2.5.5 Sand and Water

Sand shall conform to ASTM C 144. Water shall be clean, potable, and free from substances which could adversely affect the mortar.

2.6 WATER-REPELLANT ADMIXTURE

Polymeric type formulated to reduce porosity and water transmission. Construct panels of masonry units conforming to ASTM C 744 and mortar which contain the water-repellant admixture. When tested in accordance with ASTM C 1072, such panels shall have flexural strength not less than that specified or indicated. When tested in accordance with ASTM E 514, panels shall exhibit no water visible on back of test panel and no leaks through the panel after 24 hours, and not more than 25 percent of wall area shall be damp after 72 hours.

2.7 GROUT AND READY-MIXED GROUT

Grout shall conform to ASTM C 476, fine. Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 10 inches. Minimum grout strength shall be 2000 psi in 28 days, as tested by ASTM C 1019. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements. Ready-Mixed grout shall conform to ASTM C 94/C 94M.

2.7.1 Admixtures for Grout

In cold weather, a non-chloride based accelerating admixture may be used subject to approval; accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C. In general, air-entrainment, anti-freeze or chloride admixtures shall not be used except as approved by the Contracting Officer.

2.7.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.8 ANCHORS AND BAR POSITIONERS

2.8.1 Adjustable Anchors

Adjustable anchors shall be 3/16 inch diameter steel wire, triangular-shaped. Anchors attached to steel shall be 5/16 inch diameter steel bars placed to provide 1/16 inch play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

2.8.2 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.9 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615/A 615M, Grade 60 .

2.10 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000 or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 5/8 inch thick and 3/8 inch thick flanges, with a tolerance of plus or minus 1/16 inch. The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 30 degrees F after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

2.11 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07900AJOINT SEALING.

2.12 FLASHING

Flashing shall be as specified in Section 07600 SHEET METALWORK, GENERAL.

2.13 WEEP HOLE VENTILATORS

Weephole ventilators shall be prefabricated aluminum, plastic or wood blocking sized to form the proper size opening in head joints. Provide aluminum and plastic inserts with grill or screen-type openings designed to allow the passage of moisture from cavities and to prevent the entrance or insects. Ventilators shall be sized to match modular construction with a standard 3/8 inch mortar joint.

PART 3 EXECUTION

3.1 PREPARATION

Prior to start of work, masonry inspector shall verify the applicable conditions as set forth in ACI 530.1, inspection. The Contracting Officer will serve as inspector or will select a masonry inspector.

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent or the ambient air temperature exceeds 90 degrees F and the wind velocity is more than 8 mph. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F or temperature of masonry units is below 40 degrees F, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

3.1.2.1 Protection

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

- a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F.
- b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.
- c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.
- d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

- a. Mean daily air temperature 40 to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

- b. Mean daily air temperature 32 to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.
- c. Mean Daily Air Temperature 25 to 20 degrees F. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.
- d. Mean Daily Temperature 20 degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.1.3 Stains

Potect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

3.1.4 Loads

Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

3.1.5 Surfaces

Surfaces on which masonry is to be placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 1/8 inch. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2 LAYING MASONRY UNITS

Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Masonry units shall be laid in running bond pattern. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Vertical joints and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below.

3.2.1 Forms and Shores

Provide bracing and scaffolding as required. Design bracing to resist wind pressure as required by local codes. Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in

less than 10 days.

3.2.2 Reinforced Concrete Masonry Units Walls

Where vertical reinforcement occurs, fill cores solid with grout. Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be filled. Embed the adjacent webs in mortar to prevent leakage of grout. Remove mortar fins protruding from joints before placing grout. Minimum clear dimensions of vertical cores shall be 2 by 3 inches. Position reinforcing accurately as indicated before placing grout. As masonry work progresses, secure vertical reinforcing in place at vertical intervals not to exceed 160 bar diameters. Use puddling rod or vibrator to consolidate the grout. Minimum clear distance between masonry and vertical reinforcement shall be not less than 1/2 inch. Unless indicated or specified otherwise, form splices by lapping bars not less than 40 bar diameters and wire tying them together.

3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines
and surfaces of columns, walls and arises

In adjacent masonry units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variations from the plumb for external corners,
expansion joints, and other conspicuous lines

In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

TOLERANCES

Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines

In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variation from level for bed joints and top surfaces of bearing walls

In 10 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from horizontal lines

In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variations in cross sectional dimensions of columns and in thickness of walls

Minus	1/4 inch
Plus	1/2 inch

3.2.5 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.6 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.6.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed

joints.

3.2.6.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.6.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

3.2.7 Joint Widths

Joint widths shall be as follows:

3.2.7.1 Concrete Masonry Units

Concrete masonry units shall have 3/8 inch joints, except for prefaced concrete masonry units.

3.2.8 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

3.2.9 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

3.2.10 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.2.11 Partitions

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 4 inches above the ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown.

3.3 WEEP HOLES

Wherever through-wall flashing occurs, provide weep holes to drain flashing to exterior. Weep holes shall be provided not more than 24 inches on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be formed by placing short lengths of well-greased No. 10, 5/16 inch nominal diameter, braided cotton sash cord in the mortar and withdrawing the cords after the wall has been completed. Weep holes shall be constructed using weep hole ventilators. Other approved methods may be used for providing weep holes. Weep holes shall be kept free of mortar and other obstructions.

3.4 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

3.5 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

3.5.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.5.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.6 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated

spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

3.6.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.6.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

3.6.3 Grout Holes and Cleanouts

3.6.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 16 inches on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

3.6.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 32 inches where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.6.4 Grouting Equipment

3.6.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and

disposed of outside the masonry.

3.6.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

3.6.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

3.6.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.6.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The

waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2)	
			Multiwythe Masonry (3)	Hollow-unit Masonry
1	Fine	Low Lift	3/4	1-1/2 x 2
5	Fine	Low Lift	2	2 x 3
8	Fine	High Lift	2	2 x 3
12	Fine	High Lift	2-1/2	2-1/2 x 3
24	Fine	High Lift	3	3 x 3
1	Coarse	Low Lift	1-1/2	1-1/2 x 3
5	Coarse	Low Lift	2	2-1/2 x 3
8	Coarse	High Lift	2	3 x 3
12	Coarse	High Lift	2-1/2	3 x 3
24	Coarse	High Lift	3	3 x 4

Notes:

- (1) The actual grout space or cell dimension must be larger than the sum of the following items:
 - a) The required minimum dimensions of total clear areas given in the table above;
 - b) The width of any mortar projections within the space;
 - c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.
- (2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.
- (3) For grouting spaces between masonry wythes.
- (4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.7 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and

interior faces of units.

3.8 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using sash jamb units with control joint key in accordance with the details shown on the drawings. Sash jamb units shall have a 3/4 by 3/4 inch groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 3/4 inch; backer rod and sealant shall be installed in accordance with Section 07900A JOINT SEALING. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

3.9 SHELF ANGLES

Shelf angles shall be adjusted as required to keep the masonry level and at the proper elevation. Shelf angles shall be galvanized. Shelf angles shall be provided in sections not longer than 10 feet and installed with a 1/4 inch gap between sections. Shelf angles shall be mitered and welded at building corners with each angle not shorter than 4 feet, unless limited by wall configuration.

3.10 LINTELS

3.10.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 1/2 inch above the bottom inside surface of the lintel unit.

3.11 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

3.12 ANCHORAGE TO STRUCTURAL STEEL

3.12.1 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 16 inches on centers vertically, and if applicable, not over 24 inches on centers horizontally.

3.13 SPLASH BLOCKS

Splash blocks shall be located as shown.

3.14 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed

from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

3.14.1 Concrete Masonry Unit

Exposed concrete masonry unit shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.15 BEARING PLATES

Bearing plates for beams, joists, joist girders and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar and non-shrink grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.16 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.17 TEST REPORTS

3.17.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 1/2 to 5/8 inch thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

3.17.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 2000 psi at 28 days.

3.17.3 Efflorescence Test

Brick which will be exposed to weathering shall be tested for efflorescence. Tests shall be scheduled far enough in advance of starting masonry work to permit retesting if necessary. Sampling and testing shall conform to the applicable provisions of ASTM C 67. Units meeting the

definition of "effloresced" will be subject to rejection.

3.17.4 Prism Tests

At least one prism test sample shall be made for each 5,000 square feet of wall but not less than three such samples shall be made for any building. Three prisms shall be used in each sample. Prisms shall be tested in accordance with ASTM E 447. Seven-day tests may be used provided the relationship between the 7- and 28-day strengths of the masonry is established by the tests of the materials used. Compressive strength shall not be less than 1500 psi at 28 days. If the compressive strength of any prism falls below the specified value by more than 500 psi, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. If the likelihood of low-strength masonry is confirmed and computations indicate that the load-carrying capacity may have been significantly reduced, tests of cores drilled, or prisms sawed, from the area in question may be required. In such case, three specimens shall be taken for each prism test more than 500 psi below the specified value. Masonry in the area in question shall be considered structurally adequate if the average compressive strength of three specimens is equal to at least 85 percent of the specified value, and if the compressive strength of no single specimen is less than 75 percent of the specified value. Additional testing of specimens extracted from locations represented by erratic core or prism strength test results shall be permitted.

3.18 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452A SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

-- End of Section --

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DIVISION 04 - MASONRY

SECTION 04810

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SECTION 04810

NONBEARING MASONRY VENEER

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Manual	(1989) Manual of Steel Construction Allowable Stress Design
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AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Spec	(July 2002) Design of Cold-Formed Steel Structural Members and Commentary
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(2001a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2001a) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 82	(2001) Steel Wire, Plain, for Concrete Reinforcement
ASTM C 1002	(2001) Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM C 1072	(2000a) Measurement of Masonry Flexural Bond Strength
ASTM C 1177/C 1177M	(2001) Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C 216	(2001a) Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 270	(2001a) Mortar for Unit Masonry

ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 578	(2001) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 665	(2001e1) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 67	(2002) Sampling and Testing Brick and Structural Clay Tile
ASTM C 744	(1999) Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C 780	(2000) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 79/C 79M	(2001) Treated Core and Nontreated Core Gypsum Sheathing Board
ASTM C 90	(2002) Loadbearing Concrete Masonry Units
ASTM C 91	(2001) Masonry Cement
ASTM C 954	(2000) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM C 955	(2001) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM D 1056	(2000) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1330	(2000) Rubber Sheet Gaskets
ASTM D 1667	(1997) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)
ASTM D 2103	(1997) Polyethylene Film and Sheeting
ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

ASHRAE Hdbk-IP	(2001) Fundamentals Handbook, I-P Edition
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AMERICAN WELDING SOCIETY (AWS)

AWS D1.3 (1998) Structural Welding Code - Sheet Steel

U.S. DEPARTMENT OF COMMERCE (DOC)

PS-1 (1996) Construction and Industrial Plywood

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Samples

;
;
Concrete Masonry Unit; G,RE,
;
,

A portable panel, approximately 2 by 2 feet, containing approximately 24 concrete masonry units to establish the range of color and texture. One of each type of masonry veneer anchor used.

;

SD-07 Certificates

;
Concrete Masonry Unit;
;
;
;

Certificates stating that the materials and welders meet the requirements specified. Each certificate shall be signed by an authorized certification official and shall include their organization and position and shall identify the products covered under their certifying signature.

1.3 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered and handled avoiding chipping, breakage, bending or other damage, and contact with soil or other contaminating materials. The masonry products shall be stored off the ground and protected from inclement weather. Cementitious materials shall be

delivered in unopened containers plainly marked and labeled with manufacturer's names and brands. Cementitious materials shall be stored in dry, weather-tight enclosures or covers. Sand and other aggregates shall be stored preventing contamination or segregation and under a weather-tight covering permitting good air circulation. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust. Insulation, moisture barrier, and gypsum sheathing shall be stored in dry, well ventilated, weather-tight areas protected from sunlight and excessive heat. Air infiltration type vapor barrier shall be stored in accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.1 VENEER WYTHE

The source of masonry materials which will affect the appearance of the finished work shall not be changed after the work has started except with the Contracting Officer's approval.

2.1.1 Concrete Masonry Unit

Concrete masonry unit veneer shall be solid and conform to ASTM C 90. Architectural type, color range and texture shall be as indicated and shall conform to the approved sample. Masonry unit sizes shall be modular as shown.

2.2 MORTAR

Mortar shall conform to ASTM C 270, Type S. Mortar mix shall be based on proportion specifications. Laboratory testing of mortar shall be in accordance with the preconstruction evaluation of mortar section of ASTM C 780. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.2.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixtures shall be non-corrosive, contain less than 0.2 percent chlorides, and conform to ASTM C 494/C 494M, Type C.

2.3 JOINT REINFORCEMENT

Joint reinforcement shall be of steel wire conforming to ASTM A 82. Fabrication shall be by welding. Tack welding will not be permitted. Reinforcement shall be zinc-coated after fabrication in accordance with ASTM A 153/A 153M, Class B-2. Joint reinforcement shall consist of at least 1 continuous longitudinal wire in the veneer wythe. Minimum wire cross section shall be 0.017 square inches.

2.4 VENEER ANCHORS

Anchor assemblies for the attachment of the masonry veneer to the cold-formed steel framing, structural steel and concrete floor slabs shall be designed for the design loadings shown. Anchors shall transfer the design loadings from the masonry veneer to the cold-formed steel framing

system or other support without exceeding the allowable stresses and deflections in the anchors. Length of anchor wires shall be such that the outermost wires lie between 1-1/4 inch from each face of the masonry veneer. Anchors wires shall not have drips. Wires for veneer anchors shall be rectangular or triangular hoops formed from 3/16 inch diameter steel wire conforming to ASTM A 82. Anchor assemblies including wires and anchor plates shall be hot-dip galvanized conforming to ASTM A 153/A 153M, Class B-2. The veneer anchor shall have a minimum capacity of 200 pounds. The load-displacement capacity of each veneer anchor, both in direct pull-out for tension and compression, shall be not less than 2000 pounds per inch (or a deflection of 0.05 inches per 100 pounds of load in tension or compression). In the direction perpendicular to the masonry veneer, the anchor assembly shall have a maximum play of 1/16 inch.

2.5 CONNECTIONS

Screws, bolts and anchors shall be hot-dip galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.

2.5.1 Framing Screws, Bolts and Anchors

Screws, bolts and anchors used in the assembly of the cold-formed steel framing system shall be as required by design of the framing system for the specified loading. Screw, bolt and anchor sizes shall be as required.

2.5.2 Veneer Anchor Screws

Screws for attachment of the veneer anchors to the cold-formed steel framing members shall be as required by design to provide the needed pullout load capacity but not less than No. 12. The length of screws shall be such that the screws penetrate the holding member by not less than 5/8 inch.

2.6 FLASHING

Copper or stainless steel flashing shall conform to the requirements in Section 07600A SHEET METALWORK, GENERAL. Flashing shall be supplied in a continuous sheet extending across the cavity and through the masonry veneer.

2.7 CAULKING AND SEALANTS

Caulking and sealants shall be as specified in Section 07900A JOINT SEALING.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Wall sections, types of construction and dimensions shall be as shown.

3.2 VENEER ANCHORS

Veneer anchors shall be attached with screws to other support members. Veneer anchors shall be installed with the outermost wires lying between 5/8 inch from each face of the masonry veneer. A clutch torque slip screw gun shall be used on screws attaching veneer anchors to cold-formed steel members. Veneer anchors with corrugated sheet metal or wire mesh members extending across the wall cavity shall not be used. There shall be one veneer anchor for each two square feet of wall and shall be attached to supports with a maximum spacing of 24 inches on center.

3.3 FLASHING

Flashing shall also be provided at sills. Flashing shall be as specified in Section 07600 SHEET METALWORK, GENERAL. Flashing shall be lapped a minimum of 6 inches at joints and shall be sealed with a mastic as recommended by the flashing manufacturer. Flashing shall extend through the exterior face of the masonry veneer and shall be turned down to form a drip.

3.4 MASONRY VENEER

Exterior masonry wythes shall be constructed to 4" thick. A cavity consisting of a 2 inch minimum width air space will be provided between the moisture barrier and the masonry veneer. Masonry veneer shall not be installed where veneer anchors and flashing have been installed on the cold-formed steel framing system. Masonry shall be placed in running bond pattern. Vertical joints on alternating courses shall be aligned and kept vertically plumb. Solid masonry units shall be laid in a non-furrowed full bed of mortar, beveled and sloped toward the center of the wythe on which the mortar is placed. Units shall be shoved into place so that the vertical mortar joints are completely full and tight. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned and relaid. Mortar which protrudes more than 1/2 inch into the cavity space shall be removed. Means shall be provided to ensure that the cavity space is kept clean of mortar droppings and other loose debris. Chases and raked-out joints shall be kept free from mortar and debris. Faces of units used in finished exposed areas shall be free from chipped edges, material texture or color defects or other imperfections distracting from the appearance of the finished work.

3.4.1 Surface Preparation

Surfaces on which masonry is to be laid shall be cleaned of laitance or other foreign material. No units having a film of water shall be laid.

3.4.2 Hot Weather Construction

Temperatures of masonry units and mortar shall not be greater than 120 degrees F when laid. Masonry erected when the ambient air temperature is more than 99 degrees F in the shade and when the relative humidity is less than 50 percent shall be given protection from the direct exposure to wind and sun for 48 hours after the installation.

3.4.3 Cold Weather Construction

Temperatures of masonry units and mortar shall not be less than 40 degrees F when laid. When the ambient air temperature is 32 degrees F or less, masonry veneer under construction shall be protected and maintained at a temperature greater than 32 degrees F for a period of 48 hours after installation. The proposed method of maintaining the temperature within the specified range shall be submitted for approval prior to implementation. No units shall be laid on a surface having a film of frost or water.

3.4.4 Tolerances

Masonry shall be laid plumb, level and true to line within the tolerances specified in TABLE 1. All masonry corners shall be square unless otherwise

indicated on the drawings.

TABLE 1

Variation From Plumb

In adjacent units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variation From Level Or Grades

In 10 feet	1/8 inch
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variation From Linear Building Lines

In 20 feet	1/2 inch
In 40 feet or more	3/4 inch

Variation From Cross Sectional Dimensions Of Walls

Plus	1/2 inch
Minus	1/4 inch

3.4.5 Mixing of Mortar

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Measurement of sand shall be accomplished by the use of a container of known capacity or shovel count based on a container of known capacity. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of the masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours shall be discarded.

3.4.6 Cutting and Fitting

Wherever possible, full units shall be used in lieu of cut units. Where cut units are required to accommodate the design, cutting shall be done by masonry mechanics using power masonry saws. Wet-cut units shall be dried to the same surface-dry appearances of uncut units before being placed in the work. Cut edges shall be clean, true and sharp. Openings to accommodate pipes, conduits, and other accessories shall be neatly formed so that framing or escutcheons required will completely conceal the cut edges. Insofar as practicable, all cutting and fitting shall be accomplished while masonry work is being erected.

3.4.7 Masonry Units

When being laid, masonry units shall have suction sufficient to hold the mortar and to absorb water from the mortar, but shall be damp enough to allow the mortar to remain in a plastic state to permit the unit to be leveled and plumbed immediately after being laid without destroying bond. Masonry units with frogging shall be laid with the frog side down and better or face side exposed to view. Masonry units that are cored, recessed or otherwise deformed may be used in sills or in other areas except where deformations will be exposed to view.

3.4.8 Mortar Joints

Mortar joint widths shall be uniform and such that the specified widths are maintained throughout. Joints shall be of thickness equal to the difference between the actual and nominal dimensions of the masonry units in either height or length but in no case shall the joints be less than 1/4 inch nor more than 1/2 inch wide. Joints shall be tooled slightly concave.

Tooling shall be accomplished when mortar is thumbprint hard and in a manner that will compress and seal the mortar joint and produce joints of straight and true lines free of tool marks.

3.4.9 Joint Reinforcement

Unless otherwise shown, joint reinforcement shall be spaced at 16 inches on center vertically. Joint reinforcement shall not be placed in the same masonry course as veneer anchors unless the anchors are designed to accommodate the wire. Joint reinforcement shall be placed so that longitudinal wires are centered in the veneer wythe for solid units. Longitudinal wires shall be fully embedded in mortar for their entire length. Splices in joint reinforcement shall be lapped a minimum of 6 inches. Joint reinforcement must be discontinuous at all veneer joints. The minimum cover for joint reinforcement is 5/8 inches.

3.4.10 Veneer Joints

concrete masonry veneer joints shall be provided as required. Joints shall be clean and free of mortar and shall contain only backer rod and sealant, installed in accordance with Section 07900A JOINT SEALING. Horizontal reinforcement shall not extend through the joints.

3.4.11 Weep Holes

Weep holes shall be provided at all flashing locations at intervals of 24] inches. Weep holes shall be kept free of mortar and other obstructions.

3.4.12 Discontinuous Work

When necessary to temporarily discontinue the work, masonry shall be stepped back for joining when work resumes. Tothing may be used only when specifically approved. Before resuming work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned. Top of walls subjected to rain or snow shall be covered with nonstaining waterproof covering or membrane when work is not in process. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place.

3.4.13 Cleaning

Mortar daubs or splashings shall be completely removed from finished exposed masonry surfaces before they harden or set up. Before completion

of the work, defects in mortar joints shall be raked out as necessary, filled with mortar, and tooled to match the adjacent existing mortar in the joints. The proposed cleaning method shall be done on the sample wall panel and the sample panel shall be examined for discoloration or stain. If the sample panel is discolored or stained, the method of cleaning shall be changed to ensure that the masonry surfaces in the structure will not be adversely affected. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Cleaning shall be accomplished with the use of stiff bristle fiber brushes, wooden paddles, wooden scrapers, or other suitable nonmetallic tools. Concrete masonry unit surfaces shall be dry-brushed at the end of each day's work after any required pointing has been done. Efflorescence or other stains shall be removed in conformance with the recommendations of the masonry unit manufacturer. After construction and cleaning, masonry surfaces shall be left clean, free of mortar daubs, stain, and discolorations, including scum from cleaning operations, and will have tight mortar joints throughout. Metallic tools and brushes shall not be used for cleaning.

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SECTION 04850

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SECTION 04850

MANUFACTURED STONE VENEER

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Manual	(1989) Manual of Steel Construction Allowable Stress Design
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AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Spec	(July 2002) Design of Cold-Formed Steel Structural Members and Commentary
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(2001a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2001a) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 82	(2001) Steel Wire, Plain, for Concrete Reinforcement
ASTM C 1002	(2001) Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM C 1072	(2000a) Measurement of Masonry Flexural Bond Strength
ASTM C 1177/C 1177M	(2001) Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C 216	(2001a) Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 270	(2001a) Mortar for Unit Masonry

ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 578	(2001) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 665	(2001e1) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 67	(2002) Sampling and Testing Brick and Structural Clay Tile
ASTM C 744	(1999) Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C 780	(2000) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 79/C 79M	(2001) Treated Core and Nontreated Core Gypsum Sheathing Board
ASTM C 90	(2002) Loadbearing Concrete Masonry Units
ASTM C 91	(2001) Masonry Cement
ASTM C 954	(2000) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM C 955	(2001) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM D 1056	(2000) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1330	(2000) Rubber Sheet Gaskets
ASTM D 1667	(1997) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)
ASTM D 2103	(1997) Polyethylene Film and Sheeting
ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

ASHRAE Hdbk-IP	(2001) Fundamentals Handbook, I-P Edition
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AMERICAN WELDING SOCIETY (AWS)

AWS D1.3 (1998) Structural Welding Code - Sheet Steel

U.S. DEPARTMENT OF COMMERCE (DOC)

PS-1 (1996) Construction and Industrial Plywood

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Samples

;
;
Stone Veneer Unit; G,RE,

; ,

A portable panel, approximately 2 by 2 feet, containing approximately 24 stone veneer units to establish the range of color and texture.

;

SD-07 Certificates

;
Stone Veneer;
;
;
;

Certificates stating that the materials and welders meet the requirements specified. Each certificate shall be signed by an authorized certification official and shall include their organization and position and shall identify the products covered under their certifying signature.

1.3 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered and handled avoiding chipping, breakage, bending or other damage, and contact with soil or other contaminating materials. The masonry products shall be stored off the ground and protected from inclement weather. Cementitious materials shall be

delivered in unopened containers plainly marked and labeled with manufacturer's names and brands. Cementitious materials shall be stored in dry, weather-tight enclosures or covers. Sand and other aggregates shall be stored preventing contamination or segregation and under a weather-tight covering permitting good air circulation. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust. Insulation, moisture barrier, and gypsum sheathing shall be stored in dry, well ventilated, weather-tight areas protected from sunlight and excessive heat. Air infiltration type vapor barrier shall be stored in accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.1 VENEER WYTHE

The source of stone materials which will affect the appearance of the finished work shall not be changed after the work has started except with the Contracting Officer's approval.

2.1.1 Stone Veneer Unit

Stone veneer unit shall be solid Architectural type, color range and texture shall be as indicated and shall conform to the approved sample. Stone size and shapes shall be random and textures of finishes product to duplicate natural stones. Stone sizes shall vary from 8" to 30". The average thickness of stone wall veneer is 1 3/4", thickness may vary from 1" to 3 1/2" depending on the texture. Color and texture shall be as shown on exterior finish schedule..

2.2 MORTAR

Mortar shall conform to ASTM C 270, Type S. Mortar mix shall be based on proportion specifications. Laboratory testing of mortar shall be in accordance with the preconstruction evaluation of mortar section of ASTM C 780. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.2.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixtures shall be non-corrosive, contain less than 0.2 percent chlorides, and conform to ASTM C 494/C 494M, Type C.

2.3 EXTERIOR SHEATHING

Plywood sheathing that is installed on the exterior side of the cold-formed steel framing system shall have a minimum thickness of 1/2 inch and shall be 4 feet wide. Plywood sheathing shall be in accordance with PS-1, grade C-D with exterior glue. Plywood sheathing shall be used at the existing Gate Houses.

2.4 MOISTURE PROTECTION

2.4.1 Moisture Barrier

The moisture barrier shall be 15-lb asphalt-saturated felt conforming to ASTM D 226 Type I (No. 15).

2.4.2 Staples

Staples for attaching the moisture barrier to the exterior sheathing shall be the type and size best suited to provide a secure connection. Staples shall be made from either galvanized steel or stainless steel wire.

2.5 Metal Lath

Metal lath shall be 18 gauge woven wire mesh or galvanized 2.5ils flat diamond mesh.

2.6 FLASHING

Copper or stainless steel flashing shall conform to the requirements in Section 07600A SHEET METALWORK, GENERAL. Flashing shall be supplied in a continuous sheet extending across the cavity and through the masonry veneer.

2.7 CAULKING AND SEALANTS

Caulking and sealants shall be as specified in Section 07900A JOINT SEALING.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Wall sections, types of construction and dimensions shall be as shown.

3.2 EXTERIOR SHEATHING

Sheathing shall be installed on the exterior face of the cold-formed steel framing system with self-drilling screws. Screws shall be located a minimum of 3/8 inch from the ends and edges of sheathing panels and shall be spaced not more than 8 inches on each supporting member except at vertical slip joints, the sheathing shall be connected to the vertical studs to prevent movement of the slip joint. Holes and gaps resulting from abandoned screw installations, from damage to panels, and from cutting and fitting of panels at junctures with doors, windows, foundation walls, floor slabs and other similar locations shall be filled with exterior rubber-base caulk.

3.3 MOISTURE PROTECTION

3.3.1 Moisture Barrier

The asphalt-saturated felt or other approved moisture barrier shall be installed on the outer face of the exterior sheathing. The moisture barrier shall be installed horizontally and shingled with each sheet lapped not less than 6 inches over the sheet below. Vertical end joints shall be lapped not less than 6 inches and shall be staggered. Attachment of the moisture barrier shall be with staples spaced not greater than 16 inches on center or as required by the manufacturer.

3.4 FLASHING

Flashing shall also be provided at sills. Flashing shall be as specified in Section 07600 SHEET METALWORK, GENERAL. Flashing shall be

lapped a minimum of 6 inches at joints and shall be sealed with a mastic as recommended by the flashing manufacturer. Flashing shall extend through the exterior face of the masonry veneer and shall be turned down to form a drip.

3.5 Stone VENEER

Mortar: apply 1/2" - 3/4" of mortar to lath, dampened masonry or metal panels covering a maximum of 10 sq ft at one time. Press the units firmly into position in soft mortar bed, wiggle and apply slight pressure to unit to ensure firm bonding, causing mortar to extrude slightly around edges of units. Place units with uniform mortar joints. Stone joints should not be over 1/2" - 3/4" in width. Remove excess mortar, do not allow mortar to set on face of units. Point and tool joints before mortar has set. Clean and finish joints in accordance with manufacture's instructions. Press each stone into the mortar setting bed firmly enough to squeeze some mortar out around the stone's edges. Apply pressure to the stone to ensure a good bond. Ensure complete coverage between the mortar bed and back surface of the stone. Mortar may also be applied to the entire back of stone. Finish, color, textures and patterns shall be as shown on the exterior finish schedule.

3.5.1 Surface Preparation

Surfaces on which masonry is to be laid shall be cleaned of laitance or other foreign material. No units having a film of water shall be laid.

3.5.2 Hot Weather Construction

Temperatures of stone units and mortar shall not be greater than 120 degrees F when laid. Stone erected when the ambient air temperature is more than 99 degrees F in the shade and when the relative humidity is less than 50 percent shall be given protection from the direct exposure to wind and sun for 48 hours after the installation.

3.5.3 Cold Weather Construction

Temperatures of stone units and mortar shall not be less than 40 degrees F when laid. When the ambient air temperature is 32 degrees F or less, stone veneer under construction shall be protected and maintained at a temperature greater than 32 degrees F for a period of 48 hours after installation. The proposed method of maintaining the temperature within the specified range shall be submitted for approval prior to implementation. No units shall be laid on a surface having a film of frost or water.

3.5.4 Mixing of Mortar

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Measurement of sand shall be accomplished by the use of a container of known capacity or shovel count based on a container of known capacity. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of the masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours shall be discarded.

3.5.5 Cutting and Fitting

Wherever possible, full units shall be used in lieu of cut units. Perform necessary cutting with proper tools to provide uniform edges; take care to prevent breaking units corners or edges..

3.5.6 Weep Holes

Weep holes shall be provided at all flashing locations at intervals of 24] inches. Weep holes shall be kept free of mortar and other obstructions.

3.5.7 Discontinuous Work

When necessary to temporarily discontinue the work, Stone shall be stepped back for joining when work resumes. Tothing may be used only when specifically approved. Before resuming work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned. Top of walls subjected to rain or snow shall be covered with nonstaining waterproof covering or membrane when work is not in process. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place.

3.5.8 Cleaning

Remove temporary covering and protection of adjacent work areas. Remove construction debris from project site. Use a strong solution of granulated soap or detergent and water with a bristle brush. Do not use a wire brush as it will cause damage to the surface. Rinse immediately with fresh water. Do not attempt to clean using acid or acid based products. do not clean with high pressure power washer. Do not use deicing chemical on areas immediately adjacent to manufactured stone application.

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SECTION 05120

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SECTION 05120
STRUCTURAL STEEL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC FCD	(1995a) Quality Certification Program Description
AISC Design Guide No. 10	(1989) Erection Bracing of Low-Rise Structural Steel Frames
AISC M013	(1983) Detailing for Steel Construction
AISC M018L	(1995) LRFD Manual of Steel Construction Volume I
AISC M019L	(1995) LRFD Manual of Steel Construction Volume II
AISC S303	(1992) Steel Buildings and Bridges
AISC S334L	(1988) Load and Resistance Factor Design Specifications for Structural Joints Using ASTM A325 or A490 Bolts
AISC S340	(1992) Metric Properties of Structural Shapes with Dimensions According to ASTM A6M
AISC S341	(1992) Seismic Provisions for Structural Steel Buildings
AISC S342L	(1993) Load and Resistance Factor Design Specification for Structural Steel Buildings

ASME INTERNATIONAL (ASME)

ANSI/ASME B46.1	(1995) Surface Texture, (Surface Roughness, Waviness, and Lay)
AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)	
ASTM A 6/A 6M	(1998a) General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A36/A36M	(1997; Rev. A) Carbon Structural Steel
ASTM A307	(1997) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A325	(1997) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A490	(1997) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A563	(1997) Carbon and Alloy Steel Nuts

ASTM A992/A992M (1998e1) Steel for Structural Shapes for Use in Building Framing

ASTM C827 (1995; R 1997) Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures

ASTM C1107 (1999) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

ASTM F436 (1993) Hardened Steel Washers

ASTM F844 (1998) Washers, Steel, Plain (Flat), Unhardened for General Use

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (2000) Structural Welding Code - Steel

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 3 (1995) Power Tool Cleaning

SSPC SP 6 (1994) Commercial Blast Cleaning

SSPC Paint 25 (1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)

SSPC PA 1 (1991) Shop, Field, and Maintenance Painting

1.2 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with AISC M018L and AISC M019L except as modified in this contract.

1.3 MODIFICATIONS TO REFERENCES

In AISC M018L and AISC M019L, AISC S342L, AISC S303, AISC S334L, and AISC S340, except as modified in this section, shall be considered a part of AISC M018L and AISC M019L and is referred to in this section as AISC M018L and AISC M019L.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Erection drawings, including description of temporary supports; G

Fabrication drawings, including description of connections; G

SD-03 Product Data

Shop primer

SD-06 Test Reports

Bolts, nuts, and washers

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

SD-07 Certificates

Steel

Bolts, nuts, and washers

Shop primer

Welding electrodes and rods

Nonshrink grout

AISC Quality Certification

Welding procedures and qualifications

1.5 AISC QUALITY CERTIFICATION

Work shall be fabricated in an AISC certified Category Sbd fabrication plant.

1.6 SEISMIC PROVISIONS

In addition to AISC M018L and AISC M019L, the structural steel system shall be provided in accordance with AISC S341.

1.7 QUALITY ASSURANCE

1.7.1 Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC M013, AISC M018L and AISC M019L. Drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS standard welding symbols. Shoring and temporary bracing shall be designed and sealed by a registered professional engineer and submitted for record purposes, with calculations, as part of the drawings.

1.7.2 Certifications

1.7.2.1 Erection Plan

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing, and a detailed sequence of welding, including each welding procedure required.

1.7.2.2 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificate shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

PART 2 PRODUCTS

2.1 STEEL

2.1.1 Structural Steel

ASTM A36/A36M.

2.1.2 High-Strength Structural Steel

2.1.2.1 Low-Alloy Steel

ASTM A992/A992M Grade 50.

2.1.3 Structural Shapes for Use in Building Framing

Wide flange shapes, ASTM A 992/A 992M.

2.1.4 Hollow Structural Sections (HSS)

ASTM A500, Grade B

2.2 BOLTS, NUTS, AND WASHERS

Provide the following unless indicated otherwise.

2.2.1 Structural Steel

2.2.1.1 Bolts

ASTM A307, Grade A; ASTM A325, . The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

2.2.1.2 Nuts

ASTM A563, Grade and Style for applicable ASTM bolt standard recommended.

2.2.1.3 Washers

ASTM F844 washers for ASTM A307 bolts, and ASTM F436 washers for ASTM A325 bolts.

2.2.2 High-Strength Structural Steel and Hollow Structural Sections (HSS)

2.2.2.1 Bolts

ASTM A325, Type 1 ASTM A490, Type 1 or 2.

2.2.2.2 Nuts

ASTM A563, Grade and Style as specified in the applicable ASTM bolt standard.

2.2.2.3 Washers

ASTM F436, plain carbon steel.

2.2.3 Foundation Anchorage

2.2.3.1 Bolts

ASTM A307.

2.2.3.2 Nuts

ASTM A563, Grade A, hex style.

2.2.3.3 Washers

ASTM F844.

2.3 STRUCTURAL STEEL ACCESSORIES

2.3.1 Welding Electrodes and Rods

AWS D1.1.

2.3.2 Nonshrink Grout

ASTM C1107, with no ASTM C827 shrinkage.

2.4 SHOP PRIMER

SSPC Paint 25, alkyd primer. Primer shall conform to Federal, State, and local VOC regulations. If flash rusting occurs, re-clean the surface prior to application of primer.

2.5 FABRICATION

2.5.1 Markings

Prior to erection, members shall be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations.

2.5.2 Shop Primer

Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces, surfaces to receive sprayed-on fireproofing, or surfaces within 0.5 inch of the toe of the welds prior to welding (except surfaces on which metal decking is to be welded). Slip critical surfaces shall be primed with a Class B coating. Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 40 degrees F within 48 hours after application, unless approved otherwise by the Contracting Officer.

2.5.2.1 Cleaning

SSPC SP 6, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

2.5.2.2 Primer

Apply primer to a minimum dry film thickness of 2.0 mil except provide the Class B coating for slip critical joints in accordance with the coating manufacturer's recommendations. Repair damaged primed surfaces with an additional coat of primer.

2.5.3 Fireproofing

Surfaces to receive sprayed-on fireproofing coatings shall be cleaned and prepared in accordance with the manufacturer's recommendations.

2.5.4 Surface Finishes

ANSI/ASME B46.1 maximum surface roughness of 125 for pin, pinholes, and sliding bearings, unless indicated otherwise.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC ASD Manual. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be certified under the AISC FCD for Category A structural steelwork. Compression joints depending on contact bearing shall have a surface roughness not in excess of 500 micro inches as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A 6/A 6M. Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with endorsement "P" of AISC FCD and primed with the specified paint.

3.2 ERECTION

- a: Erection of structural steel, except as indicated in item b. below, shall be in accordance with the applicable provisions of AISC LRFD Vol I. Erection plan shall be reviewed, stamped and sealed by a licensed structural engineer.
- b. For low-rise structural steel buildings (60 feet tall or less and a maximum of 2 stories), the erection plan shall conform to AISC Pub No. S303 and the structure shall be erected in accordance with AISC Design Guide No. 10.

Provide for drainage in structural steel. After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

3.2.1 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

3.3 CONNECTIONS

Except as modified in this section, connections not detailed shall be designed in accordance with AISC S342L. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Punch, subpunch and ream, or drill bolt holes. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

3.3.1 Common Grade Bolts

ASTM A307 bolts shall be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

3.3.2 High-Strength Bolts

ASTM A325 bolts shall be fully tensioned to 70 percent of their minimum tensile strength. Bolts shall be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

3.4 WELDING

AWS D1.1 Provide AWS D1.1 qualified welders, welding operators, and tackers.

The contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

3.4.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Remove only from finished areas.

3.5 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.5.1 Field Priming

Field priming of steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

3.6 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of weld inspection.

3.6.1 Welds

3.6.1.1 Visual Inspection

AWS D1.1. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections. Welding inspectors shall visually inspect and mark welds,

including fillet weld end returns.

3.6.1.2 Nondestructive Testing

AWS D1.1. Test locations shall be selected by the Contracting Officer. If more than 20 percent of welds made by a welder contain defects identified by testing, then all welds made by that welder shall be tested by radiographic or ultrasonic testing, as approved by the Contracting Officer.

When all welds made by an individual welder are required to be tested, magnetic particle testing shall be used only in areas inaccessible to either radiographic or ultrasonic testing. Retest defective areas after repair.

- a. Testing frequency: Provide the following types and number of tests:

<u>Test Type</u>	<u>Number of Tests</u>
Dye Penetrant	5%

3.6.2 High-Strength Bolts

3.6.2.1 Testing Bolt, Nut, and Washer Assemblies

Test a minimum of 3 bolt, nut, and washer assemblies from each mill certificate batch in a tension measuring device at the job site prior to the beginning of bolting start-up. Demonstrate that the bolts and nuts, when used together, can develop tension not less than the provisions specified in AISC S334L, Table 4, depending on bolt size and grade. The bolt tension shall be developed by tightening the nut. A representative of the manufacturer or supplier shall be present to ensure that the fasteners are properly used, and to demonstrate that the fastener assemblies supplied satisfy the specified requirements.

3.6.2.2 Inspection

Inspection procedures shall be in accordance with AISC S334L, Section 9. Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

3.6.2.3 Testing

The Government has the option to perform nondestructive tests on 5 percent of the installed bolts to verify compliance with pre-load bolt tension requirements. The nondestructive testing will be done in-place using an ultrasonic measuring device or any other device capable of determining in-place pre-load bolt tension. The test locations shall be selected by the Contracting Officer. If more than 10 percent of the bolts tested contain defects identified by testing, then all bolts used from the batch from which the tested bolts were taken, shall be tested. Retest new bolts after installation.

3.7 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

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SECTION 05300A

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SECTION 05300A

STEEL DECKING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl (1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 611	(1997) Structural Steel (SS), Sheet, Carbon, Cold-Rolled
ASTM A 653/A 653M	(2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 780	(2000) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM A 792/A 792M	(1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3	(1998) Structural Welding Code - Sheet Steel
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STEEL DECK INSTITUTE (SDI)

SDI Diaphragm Mnl	(1991) Diaphragm Design Manual
SDI Pub No. 29	(1995) Design Manual for Composite Decks,

Form Decks, Roof Decks, and Cellular Metal
Floor Deck with Electrical Distribution

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20

(1991) Zinc-Rich Primers (Type I -
"Inorganic" and Type II - "Organic")

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Deck Units;
Accessories;
Attachments;
Holes and Openings;

Drawings shall include type, configuration, structural properties, location, and necessary details of deck units, accessories, and supporting members; size and location of holes to be cut and reinforcement to be provided; location and sequence of welded connections; and the manufacturer's erection instructions.

SD-03 Product Data

Deck Units;

Design computations for the structural properties of the deck units or SDI certification that the units are designed in accordance with SDI specifications.

Attachments;

Prior to welding operations, copies of qualified procedures and lists of names and identification symbols of qualified welders and welding operators.

SD-04 Samples

Deck Units;
Accessories;

A 2 sq. ft. sample of the decking material to be used, along with a sample of each of the accessories used.

SD-07 Certificates

Deck Units;
Attachments;

Manufacturer's certificates attesting that the decking material meets the specified requirements. Manufacturer's certificate attesting that the operators are authorized to use the

low-velocity piston tool.

1.3 DELIVERY, STORAGE, AND HANDLING

Deck units shall be delivered to the site in a dry and undamaged condition, stored off the ground with one end elevated, and stored under a weathertight covering permitting good air circulation. Finish of deck units shall be maintained at all times by using touch-up paint whenever necessary to prevent the formation of rust.

PART 2 PRODUCTS

2.1 DECK UNITS

Deck units shall conform to SDI Pub No. 29. Panels of maximum possible lengths shall be used to minimize end laps. Deck units shall be fabricated in lengths to span 3 or more supports with flush, telescoped, or nested 2 inchlaps at ends, and interlocking, or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI Cold-Formed Mnl, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

2.1.1 Roof Deck

Steel deck used in conjunction with insulation and built-up roofing shall conform to ASTM A 792/A 792M, ASTM A 611 or ASTM A 792/A 792M. Roof deck units shall be fabricated of the steel design thickness required by the design drawings and shall be zinc-coated in conformance with ASTM A 653/A 653M, G90 coating class. For underside of deck exposed to the weather paint per Section 09900 PAINTS AND COATINGS.

2.2 TOUCH-UP PAINT

Touch-up paint for zinc-coated units shall be an approved galvanizing repair paint with a high-zinc dust content. Welds shall be touched-up with paint conforming to SSPC Paint 20 in accordance with ASTM A 780. Finish of deck units and accessories shall be maintained by using touch-up paint whenever necessary to prevent the formation of rust.

2.3 ADJUSTING PLATES

Adjusting plates or segments of deck units shall be provided in locations too narrow to accommodate full-size units. As far as practical, the plates shall be the same thickness and configuration as the deck units.

2.4 CLOSURE PLATES

2.4.1 Closure Plates for Roof Deck

Voids above interior walls shall be closed with sheet metal where shown. Open deck cells at parapets, end walls, eaves, and openings through roofs shall be closed with sheet metal. Sheet metal shall be same thickness as deck units.

2.4.2 Closure Plates for Deck

2.4.2.1 Column Closures to Close Openings

Column closures to close openings between steel deck and structural steel columns.

2.4.2.2 Sheet Metal

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.5 ACCESSORIES

The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation. Metal accessories shall be of the same material as the deck and have minimum design thickness as follows: saddles, 0.0474 inch; welding washers, 0.0598 inch; cant strip, 0.0295 inch; other metal accessories, 0.0358 inch; unless otherwise indicated. Accessories shall include but not be limited to saddles, welding washers, cant strips, butt cover plates, underlapping sleeves, and ridge and valley plates.

PART 3 EXECUTION

3.1 ERECTION

Erection of deck and accessories shall be in accordance with SDI Pub No. 29, SDI Diaphragm Mnl and the approved detail drawings. Damaged deck and accessories including material which is permanently stained or contaminated, with burned holes or deformed shall not be installed. The deck units shall be placed on secure supports, properly adjusted, and aligned at right angles to supports before being permanently secured in place. The deck shall not be used for storage or as a working platform until the units have been secured in position. Loads shall be distributed by appropriate means to prevent damage during construction and to the completed assembly. The maximum uniform distributed storage load shall not exceed the design live load. There shall be no loads suspended directly from the steel deck.

3.2 ATTACHMENTS

All fasteners shall be installed in accordance with the manufacturer's recommended procedure, except as otherwise specified. The deck units shall be welded with nominal 5/8 inch diameter puddle welds to supports as indicated on the design drawings and in accordance with requirements of SDI Pub No. 29. All welding of steel deck shall be in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturer of the steel deck being used. Welds shall be made only by operators previously qualified by tests prescribed in AWS D1.3 to perform the type of work required. Welding washers shall not be used at the connections of the deck to supports. Welding washers shall not be used at sidelaps. Holes and similar defects will not be acceptable. Deck ends shall be lapped 2 inches. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI Diaphragm Mnl.

3.3 HOLES AND OPENINGS

All holes and openings required shall be coordinated with the drawings,

specifications, and other trades. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 6 inches across require no reinforcement. Holes and openings 6 to 12 inches across shall be reinforced by 0.0474 inch thick steel sheet at least 12 inches wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inches on center. Holes and openings larger than 12 inches shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists. Openings must not interfere with seismic members such as chords and drag struts.

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SECTION 05500A

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SECTION 05500A

MISCELLANEOUS METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(1997) Designation System for Aluminum Finishes
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AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.3	(1992) Ladders - Fixed - Safety Requirements
------------	--

ANSI MH28.1	(1982) Design, Testing, Utilization, and Application of Industrial Grade Steel Shelving
-------------	---

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(2001) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
-------------------	--

ASTM A 283/A 283M	(2000) Low and Intermediate Tensile Strength Carbon Steel Plates
-------------------	--

ASTM A 36/A 36M	(2000a) Carbon Structural Steel
-----------------	---------------------------------

ASTM A 467/A 467M	(1998) Machine and Coil Chain
-------------------	-------------------------------

ASTM A 475	(1998) Zinc-Coated Steel Wire Strand
------------	--------------------------------------

ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
------------	--

ASTM A 53/A 53M	(2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
-----------------	--

ASTM A 653/A 653M	(2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
-------------------	--

ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
-------------------	---

ASTM B 221	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 26/B 26M	(1999) Aluminum-Alloy Sand Castings
ASTM B 429	(2000) Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM D 2047	(1999) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine
ASTM E 814	(2000) Fire Tests of Through-Penetration Fire Stops
ASTM F 1267	(1991; R 1997) Metal, Expanded, Steel

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(1998) Minimum Design Loads for Buildings and Other Structures
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AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2000) Structural Welding Code - Steel
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NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(1994) Metal Bar Grating Manual
NAAMM MBG 532	(1994) Heavy Duty Metal Bar Grating Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(1998; Errata 10-98-1) Portable Fire Extinguishers
NFPA 211	(2000) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-344	(Rev B) Lacquer, Clear Gloss, Exterior, Interior
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Miscellaneous Metal Items; .

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates.

SD-04 Samples

Miscellaneous Metal Items; .

Samples shall be full size, taken from manufacturer's stock, and shall be complete as required for installation in the structure. Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1/D1.1M. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M, ASTM A 653/A 653M, or ASTM A 924/A 924M, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous

metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

1.7 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have standard mill finish. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Items to be anodized shall receive a polished satin finish. Aluminum surfaces to be in contact with plaster or concrete during construction shall be protected with a field coat conforming to CID A-A-344.

1.8 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

PART 2 PRODUCTS

2.1 VENTSS

Vents shall be designed and constructed in accordance with NFPA 211. Seams and joints shall be welded, except that an angle flange shall be provided for connection to the boiler, other equipment, and stack support.

2.2 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

2.3 STEEL DOOR FRAMES

Steel door frames built from structural shapes shall be neatly mitered and securely welded at the corners with all welds ground smooth. Jambs shall be provided with 2 by 1/4 by 12 inch bent, adjustable metal anchors spaced not over 2 feet 6 inches on centers. Provision shall be made to stiffen the top member for all spans over 3 feet. Continuous door stops shall be made of 1-1/2 by 5/8 inch bars.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 REMOVABLE ACCESS PANELS

A removable access panel not less than 12 by 12 inches shall be installed

directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

3.3 INSTALLATION OF VENTS

Vents shall be installed in accordance with NFPA 211.

3.4 DOOR FRAMES

Door frames shall be secured to the floor slab by means of angle clips and expansion bolts. Continuous door stops shall be welded to the frame or tap screwed with countersunk screws at no more than 18 inchcenters, assuring in either case full contact with the frame. Any necessary reinforcements shall be made and the frames shall be drilled and tapped as required for hardware.

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SECTION 06100A

ROUGH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN FOREST & PAPER ASSOCIATION (AF&PA)

AF&PA T101 (1991; Supple 1993; Addenda Apr 1997; Supple T02) National Design Specification for Wood Construction

AF&PA T11 (1988) Manual for Wood Frame Construction
**

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

AHA A194.1 (1985) Cellulosic Fiber Board

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

AITC 109 (1990) Standard for Preservative Treatment of Structural Glued Laminated Timber

AITC 111 (1979) Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection

AITC 190.1 (1992) Wood Products - Structural Glued Laminated Timber

AITC TC Manual (1994) Timber Construction Manual

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A208.1 (1999) Particleboard Mat Formed Woods

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 307 (2000) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM C 1136 (1995) Flexible, Low Permeance Vapor Retarders for Thermal Insulation

ASTM C 1177/C 1177M (1999) Glass Mat Gypsum Substrate for Use as Sheathing

ASTM C 1289	(1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C 208	(1995) Cellulosic Fiber Insulating Board
ASTM C 516	(1980; R 1996el) Vermiculite Loose Fill Thermal Insulation
ASTM C 518	(1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 549	(1981; R 1995el) Perlite Loose Fill Insulation
ASTM C 552	(2000) Cellular Glass Thermal Insulation
ASTM C 553	(1999) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 612	(2000) Mineral Fiber Block and Board Thermal Insulation
ASTM C 665	(1998) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 726	(2000) Mineral Fiber Roof Insulation Board
ASTM C 739	(2000) Cellulosic Fiber (Wood-Base) Loose-Fill Thermal Insulation
ASTM C 764	(1999) Mineral Fiber Loose-Fill Thermal Insulation
ASTM C 79/C 79M	(2000) Treated Core and Nontreated Core Gypsum Sheathing Board
ASTM D 2898	(1994; R 1999) Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
ASTM D 3498	(1999) Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
ASTM E 154	(1988; R 1999) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
ASTM E 84	(2000a) Surface Burning Characteristics of

Building Materials

- ASTM E 96 (2000) Water Vapor Transmission of Materials
- ASTM F 547 (1977; R 1995) Definitions of Terms Relating to Nails for Use with Wood and Wood-Based Materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

- AWPA C2 (2000) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
- AWPA C20 (1999) Structural Lumber Fire-Retardant Pressure Treatment
- AWPA C27 (1999) Plywood - Fire-Retardant Pressure Treatment
- AWPA C9 (1997) Plywood - Preservative Treatment by Pressure Processes
- AWPA M4 (1999) Standard for the Care of Preservative-Treated Wood Products
- AWPA P5 (2000) Standards for Waterborne Preservatives

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

- APA EWS R540C (1996) Builder Tips Proper Storage and Handling of Glulam Beams
- APA EWS T300D (1997) Technical Note Glulam Connection Details
- APA E445R (1980; Rev Jan 1996) Performance Standards and Policies for Structural-Use Panels

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

- FM LPDS 1-49 (1995) Loss Prevention Data Sheet - Perimeter Flashing

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

- NHLA Rules (1994) Rules for the Measurement & Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

- NELMA Grading Rules (1997) Standard Grading Rules for Northeastern Lumber

REDWOOD INSPECTION SERVICE (RIS)

- RIS Grade Use (1997) Grades of California Redwood Lumber

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Spec (1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (1994; Supple 8 thru 11) Standard Grading Rules for Southern Pine Lumber

TRUSS PLATE INSTITUTE (TPI)

TPI 1 (1995; Errata) National Design Standard for Metal Plate-Connected Wood Truss Construction and Commentary; and Appendix 1

TPI HIB (1991) Handling, Installing and Bracing of Metal Plate Connected Wood Trusses

U.S. DEPARTMENT OF COMMERCE (DOC)

PS1 (1995) Construction and Industrial Plywood

PS2 (1993) Wood-Base Structural-Use Panels

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1209 Interim Safety Standard for Cellulose Insulation

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17 (1996; Supp. VII & VIII) Standard Grading and Dressing Rules for Douglas Fir, Western Hemlock, Western Red Cedar, White Fir, Sitka Spruce Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA Grading Rules (1999) Western Lumber Grading Rules 95

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Nailers and Nailing Strips;

Drawings of field erection details, including materials and methods of fastening nailers in conformance with Factory Mutual

wind uplift rated systems specified in other Sections of these specifications.

SD-07 Certificates

Insulation;

Certificate attesting that the cellulose, perlite, glass and mineral fiber, glass mat gypsum roof board, polyurethane, or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity. Laminated timber shall be handled and stored in accordance with AITC 111 or APA EWS R540C.

PART 2 PRODUCTS

2.1 LUMBER AND SHEATHING

2.1.1 Sizes

Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Unless otherwise specified, sizes indicated are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.2 Miscellaneous Wood Members

2.1.2.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

Member	Size (inch)
Nailing strips	1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock.

2.1.2.2 Blocking

Blocking shall be standard or number 2 grade.

2.2 ACCESSORIES AND NAILS

Markings shall identify both the strength grade and the manufacturer. Accessories and nails shall conform to the following:

2.2.1 Anchor Bolts

ASTM A 307, size as indicated, complete with nuts and washers.

2.2.2 Bolts: Lag, Toggle, and Miscellaneous Bolts and Screws

Type, size, and finish best suited for intended use. Finish options include zinc compounds, cadmium, and aluminum paint impregnated finishes.

2.2.3 Clip Angles

Steel, 3/16 inch thick, size best suited for intended use; or zinc-coated steel or iron commercial clips designed for connecting wood members.

2.3 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown.

R-values shall be determined at 75 degrees F in accordance with ASTM C 518.

Contractor shall comply with EPA requirements in conformance with Section 01670 RECYCLED / RECOVERED MATERIALS. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Materials containing more than one percent asbestos will not be allowed.

2.3.1 Batt or Blanket

2.3.1.1 Mineral Fiber Batt

Mineral fiber batt shall conform to ASTM C 665, Type III foil faced insulation Class C.

2.3.1.2 Mineral Fiber Blanket

Mineral fiber blanket shall conform to ASTM C 553, Type I, Class 6. Blankets shall be sized to suit construction conditions, resilient type for use below and above ambient temperature to 350 degrees F. Blankets shall have a factory applied vapor-barrier facing on one side with 2 inch nailing tabs on both edges. Vapor barriers shall be fire retardant, high vapor transmission, and aluminum foil laminated to crepe paper type conforming to ASTM C 1136, Type II. Nominal density shall be 0.75 pcf.

2.3.3 Rigid Insulation

2.3.3.1 Polystyrene Board

Polystyrene board shall be extruded and conform to ASTM C 578, Type IV.

2.3.3.2 Polyurethane or Polyisocyanurate Board

Polyurethane or polyisocyanurate board shall have a minimum recovered material content of 5 percent by weight of core material in the polyurethane or polyisocyanurate portion. Unfaced preformed polyurethane shall conform to ASTM C 591. Faced polyisocyanurate shall conform to ASTM C 1289.

PART 3 EXECUTION

3.1 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS

3.1.1 Blocking

Blocking shall be provided as necessary for application of siding, sheathing, subflooring, wallboard, and other materials or building items, and to provide firestopping. Blocking for firestopping shall ensure a maximum dimension of 8 feet for any concealed space. Blocking shall be cut to fit between framing members and rigidly nailed thereto.

3.1.2 Nailers and Nailing Strips

Nailers and nailing strips shall be provided as necessary for the attachment of finish materials. Nailers used in conjunction with roof deck installation shall be installed flush with the roof deck system. Stacked nailers shall be assembled with spikes or nails spaced not more than 18 inches on center and staggered. Beginning and ending nails shall not be more than 6 inches for nailer end. Ends of stacked nailers shall be offset approximately 12 inches in long runs and alternated at corners. Anchors shall extend through the entire thickness of the nailer. Strips shall be run in lengths as long as practicable, butt jointed, cut into wood framing members when necessary, and rigidly secured in place. Nailers and nailer installation for Factory Mutual wind uplift rated roof systems specified in other Sections of these specifications shall conform to the recommendations contained in FM LPDS 1-49.

3.2 INSTALLATION OF INSULATION

Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For thermal insulation the actual installed thickness shall provide the R-values shown. For acoustical insulation the installed thickness shall be as shown. Insulation shall be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

3.3 TABLES

TABLE I. SPECIES AND GRADE

Subflooring, Roof Sheathing, Wall Sheathing, Furring

Grading Rules	Species	Const Standard	No. 2 Comm	No. 2 Board Comm	No. 3 Comm
<hr/>					
WCLIB 17	Douglas Fir-Larch	X			
	Hem-Fir	X			
	Sitka Spruce	X			
	Mountain Hemlock	X			
	Western Cedar	X			
WWPA Grading Rules					
	Douglas Fir-Larch	X			
	Hem-Fir	X			
	Idaho White Pine	X			
	Lodgepole Pine				X
	Ponderosa Pine				X
	Sugar Pine				X
	Englemann Spruce				X
	Douglas Fir South				X
	Mountain Hemlock				X
	Subalpine Fir				X
	Western Cedar				X

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SECTION 07416A

STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA ADM	(2000) Aluminum Design Manual: Specification & Guidelines for Aluminum Structures
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AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 335	(1989) Specification for Structural Steel Buildings - Allowable Stress Design, Plastic Design
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AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-973	(1996) Cold-Formed Steel Design Manual
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463/A 463M	(2000) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 653/A 653M	(2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 792/A 792M	(1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM B 209	(2000) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2000) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C 1177/C 1177M	(1999) Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C 1289	(1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C 518	(1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

ASTM C 991	(1998) Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings
ASTM D 1308	(1987; R 1998) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	(1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(1999) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 1999e1) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM D 4214	(1998) Evaluating Degree of Chalking of Exterior Paint Films
ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D 522	(1993a) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Specular Gloss
ASTM D 5894	(1996) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM D 610	(1995) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(1987; R 1994e1) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 1592	(1998) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E 84	(2000a) Surface Burning Characteristics of Building Materials
ASTM E 96	(2000) Water Vapor Transmission of

Materials

ASTM G 154 (2000a) Standard Practice for Operating
Fluorescent Light Apparatus for UV
Exposure of Nonmetallic Materials

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (1998) Minimum Design Loads for Buildings
and Other Structures

STEEL JOIST INSTITUTE (SJI)

SJI Specs & Tables (1994) Standard Specifications Load Tables
and Weight Tables for Steel Joists and
Joist Girders

1.2 GENERAL REQUIREMENTS

The Contractor shall furnish a commercially available roofing system which satisfies all requirements contained herein and has been verified by load testing and independent design analyses to meet the specified design requirements.

1.2.1 Structural Standing Seam Metal Roof (SSSMR) System

The SSSMR system covered under this specification shall include the entire roofing system; the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, skylights; interior or exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system.

1.2.2 Manufacturer

The SSSMR system shall be the product of a manufacturer who has been in the practice of manufacturing and designing SSSMR systems for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

1.2.3 Installer

The installer shall be certified by the SSSMR system manufacturer to have experience in installing at least three projects that are of comparable size, scope and complexity as this project for the particular roof system furnished. The installer may be either employed by the manufacturer or be an independent installer.

1.3 DESIGN REQUIREMENTS

The design of the SSSMR system shall be provided by the Contractor as a complete system. Members and connections not indicated on the drawings shall be designed by the Contractor. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same roofing system manufacturer.

1.3.1 Design Criteria

Design criteria shall be in accordance with ASCE 7.

1.3.2 Dead Loads

The dead load shall be the weight of the SSSMR system. Collateral loads such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.

1.3.3 Live Loads

1.3.3.1 Concentrated Loads

The panels and anchor clips shall be capable of supporting a 300 pound concentrated load. The concentrated load shall be applied at the panel midspan and will be resisted by a single standing seam metal roof panel assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.

1.3.3.2 Uniform Loads

The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of 20 psf.

1.3.4 Roof Snow Loads

The design roof snow loads shall be as shown on the contract drawings.

1.3.5 Wind Loads

The design wind uplift pressure for the roof system shall be as shown on the contract drawings. The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when figuring fastener design loads.

- a. Single fastener in each connection.....3.0
- b. Two or more fasteners in each connection...2.25

1.3.6 Thermal Loads

Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of 70 degrees F during the life of the structure.

1.3.7 Framing Members Supporting the SSSMR System

Any additions/revisions to framing members supporting the SSSMR system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility and shall be submitted for review and approval. New or revised framing members and their connections shall be designed in accordance with AISC 335 AISI SG-973 SJI Specs & Tables. Maximum deflection under applied live load, snow, or wind load shall not exceed 1/180 of the span length.

1.3.8 Roof Panels Design

Steel panels shall be designed in accordance with AISI SG-973. Aluminum panels shall be designed in accordance with AA ADM. The structural section properties used in the design of the panels shall be determined using the unloaded shape of the roof panels. The calculated panel deflection from concentrated loads shall not exceed 1/180 of the span length. The calculated panel deflection under applied live load, snow, or wind load shall not exceed 1/180 times the span length. Deflections shall be based on panels being continuous across three or more supports. Deflection shall be calculated and measured along the major ribs of the panels.

1.3.9 Accessories and Their Fasteners

Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces. There shall be a minimum of two fasteners per clip. Single fasteners with a minimum diameter of 3/8 inch will be allowed when the supporting structural members are prepunched or predrilled.

1.4 PERFORMANCE REQUIREMENTS

The SSSMR shall be tested for wind uplift resistance in accordance with ASTM E 1592; SSSMR systems previously tested and approved by the Corps of Engineers' STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE may be acceptable. Two tests shall be performed. Test 1 shall simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint. The maximum span length for the edge condition shall be 30 inches. Test 2 shall simulate the interior condition with both ends free of crosswise restraint.

The maximum span length for the interior condition shall be 5.0 feet. External reinforcement, such as clamps on the ribs, may shall not be installed to improve uplift resistance. Bolts through seams shall not be installed.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Structural Standing Seam Metal Roof System; G, RE.

Metal roofing drawings and specifications and erection drawings; shop coating and finishing specifications; and other data as necessary to clearly describe design, materials, sizes, layouts, standing seam configuration, construction details, provisions for thermal movement, line of panel fixity, fastener sizes and spacings, sealants and erection procedures. Drawings shall reflect the intent of the architectural detailing using the manufacturer's proprietary products and fabricated items as required. The SSSMR system shop drawings shall be provided by the

metal roofing manufacturer.

SD-03 Product Data

Design Analysis; G, RE.

Design analysis signed by a Registered Professional Engineer employed by the SSSMR manufacturer. The design analysis shall include a list of the design loads, and complete calculations for the support system (when provided by the Contractor), roofing system and its components; valley designs, gutter/downspout calculations, screw pullout test results, and shall indicate how expected thermal movements are accommodated.

Qualifications; .

Qualifications of the manufacturer and installer.

SD-04 Samples

Accessories; .

One sample of each type of flashing, trim, closure, thermal spacer block, cap and similar items. Size shall be sufficient to show construction and configuration.

Roof Panels; .

One piece of each type to be used, 9 inches long, full width.

Factory Color Finish; G,RE, .

Three 3 by 5 inches samples of each type and color.

Fasteners; .

Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the job site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Insulation; .

One piece, 12 by 12 inches, of each type and thickness to be used, with a label indicating the rated permeance (if faced) and R-values. The flame spread, and smoke developed rating shall be shown on the label or provided in a letter of certification.

Gaskets and Insulating Compounds; .

Two samples of each type to be used and descriptive data.

Sealant; .

One sample, approximately 1 pound, and descriptive data.

Concealed Anchor Clips; .

Two samples of each type used.

EPDM Rubber Boots; .

One piece of each type.

SD-06 Test Reports

Test Report for Uplift Resistance of the SSSMR; G, ED.

The report shall include the following information:

- a. Details of the SSSMR system showing the roof panel cross-section with dimensions and thickness.
- b. Details of the anchor clip, dimensions, and thickness.
- c. Type of fasteners, size, and the number required for each connection.
- d. Purlins/subpurlins size and spacing used in the test.
- e. Description of the seaming operation including equipment used.
- f. Maximum allowable uplift pressures. These pressures are determined from the ultimate load divided by a factor of safety equal to 1.65.
- g. Any additional information required to identify the SSSMR system tested.
- h. Signature and seal of an independent registered engineer who witnessed the test.

SD-07 Certificates

Structural Standing Seam Metal Roof System;

- a. Certification that the actual thickness of uncoated sheets used in SSSMRS components including roofing panels, subpurlins, and concealed anchor clips complies with specified requirements.
- b. Certification that materials used in the installation are mill certified.
- c. Previous certification of SSSMR system tested under the Corps of Engineers' Standard Test Method in lieu of ASTM E 1592 testing.
- d. Certification that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than three pieces has been tested and has met the quality standards specified for factory color finish.

e. Certification of installer. Installer certification shall be furnished.

f. Warranty certificate. At the completion of the project the Contractor shall furnish signed copies of the 5-year Warranty for Structural Standing Seam Metal Roof (SSSMR) System, a sample copy of which is attached to this section, and the 20-year Manufacturer's Material Warranties, and the manufacturer's 20-year system weathertightness warranty.

Insulation; .

Certificate attesting that the polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage conditions shall provide good air circulation and protection from surface staining.

1.7 WARRANTIES

The SSSMR system shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

1.7.1 Contractor's Weathertightness Warranty

The SSSMR system shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The SSSMR system covered under this warranty shall include the entire roofing system including, but not limited to, the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, and skylights; interior or exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of these specifications that are part of the SSSMR system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's required warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM, and shall start upon

final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire SSSMR system as outlined above.

1.7.2 Manufacturer's Material Warranties.

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all SSSMR system components such as roof panels, anchor clips and fasteners, flashing, accessories, and trim, fabricated from coil material:

a. A manufacturer's 20 year material warranty warranting that the aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.

b. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change color in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing with an air-drying version of the specified finish or replacing the defective coated material.

c. A roofing system manufacturer's 20 year, non-prorated, system weathertightness warranty.

1.8 COORDINATION MEETING

A coordination meeting shall be held 30 days prior to the first submittal, for mutual understanding of the Structural Standing Seam Metal Roof (SSSMR) System contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roof system manufacturer, the roofing supplier, the erector, the SSSMR design engineer of record, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

PART 2 PRODUCTS

2.1 ROOF PANELS

Panels shall be steel and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 30 feet. When length of run exceeds 30 feet and panel laps are provided, each sheet in the run shall extend over three or more supports. Sheets longer than 100 feet may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than 24 inches of coverage in place. SSSMR system with roofing panels greater than 12 inches in width shall have standing seams rolled during installation by an electrically driven seaming machine.

Height of standing seams shall be not less than 2 inches .

2.1.1 Steel Panels

Steel panels shall be zinc-coated steel conforming to ASTM A 653/A 653M; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 55 50 coating; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2 65. Zinc, zinc-aluminum alloy or aluminum coated panels shall be 0.023 inch thick minimum. Panels shall be within 95 percent of reported tested thickness as noted in wind uplift resistance testing required in paragraph PERFORMANCE REQUIREMENTS. Prior to shipment, mill finish panels shall be treated with a passivating chemical to inhibit the formation of oxide corrosion products. Panels that have become wet during shipment and have started to oxidize shall be rejected.

2.2 CONCEALED ANCHOR CLIPS

Concealed anchor clips shall be the same as the tested roofing system. Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Single piece clips may be acceptable when the manufacturer can substantiate that the system can accommodate the thermal cyclic movement under sustained live or snow loads.

2.3 ACCESSORIES

Flashing, trim, metal closure strips, caps and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water. The use of a continuous angle butted to the panel ends to form a closure will not be allowed.

2.4 FASTENERS

Fasteners for steel roof panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum roof panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both tensile and shear ultimate strengths of not less than 750 pounds per fastener. Fasteners for accessories shall be the manufacturer's standard.

2.4.1 Screws

Screws for attaching anchor devices shall be not less than No. 14. Actual screw pull out test results shall be performed for the actual material gage and yield strength of the structural purlins or subpurlins to which the clip is to be anchored/attached. Other screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

2.4.2 Bolts

Bolts shall be not less than 1/4 inch diameter, shouldered or plain shank as required, with locking washers and nuts.

2.4.3 Structural Blind Fasteners

Blind screw-type expandable fasteners shall be not less than 1/4 inch diameter. Blind (pop) rivets shall be not less than 9/32 inch minimum diameter.

2.5 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated on the drawings. The exterior coating shall be a nominal 2 mil thickness consisting of a topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 1.0 mil thickness.

The interior color finish shall consist of a nominal 1 mil thick PVF2 finish otherwise the same as the exterior. The exterior color finish shall meet the test requirements specified below.

2.5.1 Salt Spray Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610; and a rating of 6, over 21/16 to 1/8 inch failure at scribe, as determined by ASTM D 1654.

2.5.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 1/8 inch diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

2.5.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM G 154, test condition UVA-340 lamp, 8h UV at 60 degrees C followed by 4h CON at 45 degrees C for 12 total hours. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating with an adhesion rating less than 4B when tested in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

2.5.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.5.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 0.500 inch diameter hemispherical head

indenter, equal to 1.5 times the metal thickness in mils, expressed in inch-pounds, with no cracking.

2.5.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 80 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.5.7 Specular Gloss

Finished roof surfaces shall have a specular gloss value of 30 or less at 60 degrees when measured in accordance with ASTM D 523.

2.5.8 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.6 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of 75 degrees F in accordance with ASTM C 518. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Insulation shall have a flame spread not in excess of 25 and a smoke developed rating not in excess of 50 when tested in accordance with ASTM E 84. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory. Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.6.1 Polyisocyanurate Rigid Board Insulation for Use Above a Roof Deck

Polyisocyanurate insulation shall conform to ASTM C 1289, Type II,. For polyisocyanurate (Ex: aluminum foil), the maximum design R-value per 1 inch of insulation used shall be 7.2. Facings shall be non-asphaltic, glass fiber reinforced.

2.6.2 Blanket Insulation

Blanket insulation shall conform to ASTM C 991.

2.7 INSULATION RETAINERS

Insulation retainers shall be type, size, and design necessary to adequately hold the insulation and to provide a neat appearance. Metallic retaining members shall be nonferrous or have a nonferrous coating. Nonmetallic retaining members, including adhesives used in conjunction with mechanical retainers or at insulation seams, shall have a fire resistance classification not less than that permitted for the insulation.

2.8 SEALANT

Sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

2.9 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.10 VAPOR RETARDER

2.10.1 Vapor Retarders Separate from Insulation

Vapor retarder material shall be polyethylene sheeting conforming to ASTM D 4397. A single ply of 10 mil polyethylene sheet; or, at the Contractor's option, a double ply of 6 mil polyethylene sheet shall be used. A fully compatible polyethylene tape which has equal or better water vapor control characteristics than the vapor retarder material shall be provided. A cloth industrial duct tape in a utility grade shall also be provided to use as needed to protect the vapor retarder from puncturing.

2.10.2 Slip Sheet for Use With Vapor Retarder

Slip sheet for use with vapor retarder shall be a 5 lb. per 100 square feet rosin-sized, unsaturated building paper.

2.11 EPDM RUBBER BOOTS

Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Molded closure strips shall be installed wherever roofing sheets terminate in open-end configurations, exclusive of flashings. The closure strip installation shall be weather-tight and sealed. Screws shall be installed with a clutching screw gun, to assure screws are not stripped. Field test shall be conducted on each gun prior to starting installation and periodically thereafter to assure it is adjusted properly to install particular type and size of screw as recommended by manufacturer's literature. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

3.1.1 Field Forming of Panels for Unique Area

When roofing panels are formed from factory-color-finished steel coils at the project site, the same care and quality control measures that are taken in shop forming of roofing panels shall be observed. Rollformer shall be operated by the metal roofing manufacturer's representative. In cold weather conditions, preheating of the steel coils to be field formed shall be performed as necessary just prior to the rolling operations.

3.1.2 Roof Panel Installation

Roof panels shall be installed with the standing seams in the direction of the roof slope. The side seam connections for installed panels shall be completed at the end of each day's work. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weather-tight installation. End laps of panels shall be provided in accordance with the manufacturer's instructions. Closures, flashings, EPDM rubber boots, roof curbs, and related accessories shall be installed according to the manufacturer's drawings. Fasteners shall not puncture roofing sheets except as provided for in the manufacturer's instructions for erection and installation. Expansion joints for the standing seam roof system shall be installed at locations indicated on the contract drawings and other locations indicated on the manufacturer's drawings.

3.1.3 Concealed Anchor Clips

Concealed anchor clips shall be fastened directly to the structural framing members. Attachment to the substrate (when provided) or to the metal deck is not permitted. The maximum distance, parallel to the seams, between clips shall be 30 inches on center at the corner, edge, and ridge zones, and 5 feet maximum on centers for the remainder of the roof.

3.2 INSULATION INSTALLATION

Insulation shall be continuous over entire roof surface. Where expansion joints, terminations, and other connections are made, the cavity shall be filled with batt insulation with vapor retarder providing equivalent R-value and perm rating as remaining insulation. Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

3.2.1 Board Insulation with Blanket Insulation

Rigid or semirigid board insulation shall be laid in close contact. Board shall be attached to the metal roof deck with bearing plates and fasteners, as recommended by the insulation manufacturer, so that the insulation joints are held tight against each other, and shall have a minimum of 1 fastener per 4 square feet. Layout and joint pattern of insulation and fasteners shall be indicated on the shop drawings. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer. A layer of blanket insulation shall be placed over the rigid or semirigid board insulation to be compressed against the underside of the metal roofing to reduce thermal bridging, dampen noise, and prevent roofing flutter. This layer of blanket insulation shall be compressed a minimum of 50 percent.

3.3 PROTECTION OF VAPOR RETARDER FROM ROOF DECK

A cloth industrial duct tape shall be applied over the seams of metal roof decks, at penetration edges, and at surface areas exhibiting sharp burrs or

similar protrusions. For other types of roof decks, cloth industrial duct tape shall be applied over irregularities which could potentially puncture polyethylene membrane.

3.4 VAPOR RETARDER INSTALLATION

3.4.1 Integral Facing on Blanket Insulation

Integral facing on blanket insulation shall have the facing lapped and sealed with a compatible tape to provide a vapor tight membrane.

3.4.2 Polyethylene Vapor Retarder

The polyethylene vapor retarder membrane shall be installed over the entire surface. A fully compatible polyethylene tape shall be used to seal the edges of the sheets to provide a vapor tight membrane. Sheet edges shall be lapped not less than 6 inches. Sufficient material shall be provided to avoid inducing stresses in the sheets due to stretching or binding. All tears or punctures that are visible in the finished surface at any time during the construction process shall be sealed with polyethylene tape.

3.5 SLIP SHEET INSTALLATION

A slip sheet shall be laid over the blanket insulation facing to prevent the vinyl facing from adhering to the metal roofing.

3.6 CLEANING AND TOUCH-UP

Exposed SSSMR systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

FACILITY DESCRIPTION_____

BUILDING NUMBER:_____

CORPS OF ENGINEERS CONTRACT NUMBER:_____

CONTRACTOR

CONTRACTOR:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

OWNER

OWNER:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

CONSTRUCTION AGENT

CONSTRUCTION AGENT:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

THE SSSMR SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH ASTM E 1592. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE SSSMR SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

(Company President)

(Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE SSSMR SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE SSSMR SYSTEM DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE SSSMR SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

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CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

**REPORTS OF LEAKS AND SSSMR SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE SSSMR SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07600A

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SECTION 07600A

SHEET METALWORK, GENERAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B 209	(2000) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2000) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 32	(1996) Solder Metal
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 2822	(1991; R 1997e1) Asphalt Roof Cement
ASTM D 3656	(1997) Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
ASTM D 4022	(1994) Coal Tar Roof Cement, Asbestos Containing
ASTM D 4586	(1993; R 1999) Asphalt Roof Cement, Asbestos Free

ASTM D 543	(1995) Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 822	(1996) Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus
ASTM D 828	(1997) Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation-Apparatus
ASTM E 96	(2000) Water Vapor Transmission of Materials

INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

ISWA IWS 089	(1990) Recommended Standards and Specifications for Insect Wire Screening (Wire Fabric)
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SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Arch. Manual	(1993; Errata; Addenda Oct 1997) Architectural Sheet Metal Manual
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1.2 GENERAL REQUIREMENTS

Sheet metalwork shall be accomplished to form weathertight construction without waves, warps, buckles, fastening stresses or distortion, and shall allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Materials;

Drawings of sheet metal items showing weights, gauges or thicknesses; types of materials; expansion-joint spacing; fabrication details; and installation procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Lead, lead-coated metal, and galvanized steel shall not be used. Any metal listed by SMACNA Arch. Manual for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in SMACNA Arch. Manual. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

2.1.1 Accessories

Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided.

2.1.2 Aluminum Extrusions

ASTM B 221, Alloy 6063, Temper T5.

2.1.3 Bituminous Cement

Type I asphalt cement conforming to ASTM D 2822 or ASTM D 4586. For coal tar roofing; coal tar cement conforming to ASTM D 4022.

2.1.4 Sealant

Unless otherwise specified, sealant shall be an elastomeric weather resistant sealant as specified in Section 07900 JOINT SEALING.

2.1.5 Fasteners

Fasteners shall be compatible with the fastened material and shall be the type best suited for the application.

2.1.6 Felt

ASTM D 226, Type I.

2.1.7 Polyvinyl Chloride (PVC) Reglets

ASTM D 1784, Class 14333D, 0.075 inch minimum thickness.

2.1.8 Aluminum Alloy Sheet and Plate

ASTM B 209, anodized clear, form, alloy, and temper appropriate for use.

2.1.9 Copper

ASTM B 370, Temper H 00.

2.1.10 Stainless Steel

ASTM A 167, Type 302 or 304; fully annealed, dead soft temper.

2.1.11 Solder

ASTM B 32, 95-5 tin-antimony.

2.1.12 Through-Wall Flashing

- b. Stainless steel, Type 304, not less than 0.01 inch thick, completely encased by and permanently bonded on both sides to 50 pound high strength bituminized crepe kraft paper, using hot asphalt, heat, and pressure.
- e. Other through-wall flashing material may be used provided the following performance criteria are met.
 - (1) No cracking or flaking when bent 180 degrees over a 1/32 inch mandrel and rebent at the same point over the same mandrel in an opposite direction at 32 degrees F.
 - (2) Water vapor permeability not more than 2 perms when tested in accordance with ASTM E 96.
 - (3) Minimum breaking strength of 90 pounds per inch width in the weakest direction when tested in accordance with ASTM D 828.
 - (4) No visible deterioration after being subjected to a 400-hour direct weathering test in accordance with ASTM D 822.
 - (5) No shrinkage in length or width and less than 5 percent loss of breaking strength after a 10-day immersion, per ASTM D 543, in 5 percent (by weight) solutions, respectively, of sulfuric acid, hydrochloric acid, sodium hydroxide or saturated lime (calcium hydroxide).

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Gutters and downspouts shall be designed and fabricated in conformance with SMACNA Arch. Manual; Unless otherwise specified or indicated, exposed edges shall be folded back to form a 1/2 inch hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips.

3.2 PROTECTION OF ALUMINUM

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods:

3.2.1 Paint

Aluminum surfaces shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint as specified in Section 09900 PAINTING, GENERAL.

3.2.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and cemented to the aluminum surface using a cement compatible with aluminum.

3.3 CONNECTIONS AND JOINTING

3.3.1 Soldering

Soldering shall apply to copper, and stainless steel items. Edges of sheet metal shall be pretinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

3.3.2 Riveting

Joints in aluminum sheets 0.040 inch or less in thickness shall be mechanically made.

3.3.3 Seaming

Flat-lock and soldered-lap seams shall finish not less than 1 inch wide. Unsoldered plain-lap seams shall lap not less than 3 inches unless otherwise specified. Flat seams shall be made in the direction of the flow.

3.4 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints of cleats shall be spaced approximately 1/8 inch apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 12 inches on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry.

3.5 FLASHINGS

Flashings shall be installed at locations indicated and as specified below.

Sealing shall be according to the flashing manufacturer's recommendations.

Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof, and floor drains, and for electrical conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be covered up by an application of bituminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement. Flashing shall be formed to direct water to the outside of the system.

3.5.1 Through-Wall Flashing

Through-wall flashing includes sill, lintel, and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing

so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further into the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills.

3.5.1.1 Sill Flashing

Sill flashing shall extend the full width of the sill and not less than 4 inches beyond ends of sill except at control joint where the flashing shall be terminated at the end of the sill.

3.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- b. Verification of compliance of materials before, during, and after installation.
- c. Inspection of sheet metalwork for proper size and thickness, fastening and joining, and proper installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer at the end of each day.

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SECTION 07900A

JOINT SEALING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509	(1994) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 570	(1995) Oil- and Resin-Base Caulking Compound for Building Construction
ASTM C 734	(1993) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C 834	(1995) Latex Sealants
ASTM C 920	(1998) Elastomeric Joint Sealants
ASTM C 1085	(1991) Butyl Rubber-Based Solvent-Release Sealants
ASTM C 1184	(1995e1) Structural Silicone-Sealants
ASTM D 217	(1997) Cone Penetration of Lubricating Grease (IP50/88)
ASTM D 1056	(1998) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1565	(1999) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam)
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Backing; .

Bond-Breaker; .

Sealant; .

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

SD-07 Certificates

Sealant; .

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 40 to 90 degrees F when the sealants are applied.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The container label or accompanying data sheet shall include the following information as applicable: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time at the standard conditions for laboratory tests. Materials shall be handled and stored to prevent inclusion of foreign materials. Materials shall be stored at temperatures between 40 and 90 degrees F unless otherwise specified by the manufacturer.

PART 2 PRODUCTS

2.1 BACKING

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

2.1.1 Rubber

] Cellular rubber sponge backing shall be ASTM D 1056, [Type 2, closed cell, Class A, Grade 2, round cross section.

2.1.2 PVC

Polyvinyl chloride (PVC) backing shall be ASTM D 1565, Grade VO 12, open-cell foam, round cross section.

2.1.3 Synthetic Rubber

Synthetic rubber backing shall be ASTM C 509, Option I , Type I preformed rods or tubes.

2.1.4 Neoprene

Neoprene backing shall be ASTM D 1056, closed cell expanded neoprene cord Type 2, Class C, Grade 2C2 .

2.2 BOND-BREAKER

Bond-breaker shall be as recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.3 PRIMER

Primer shall be non-staining type as recommended by sealant manufacturer for the application.

2.4 SEALANT

2.4.1 LATEX

Type A Latex Sealant shall be ASTM C 834.

2.4.2 ELASTOMERIC

Elastomeric sealants shall conform to ASTM C 920 and the following:

- a. Type B Polysulfide Sealant: Type S , Grade NS , Class 25 , Use NT, G A .
- b. Type C Polyurethane sealant: Grade NS , Class 25 , Use NT G A .
- c. Type D Silicone sealant: Type S , Grade NS , Class 25 , Use NT, G A or O.

2.4.3 BUTYL

Type G Butyl sealant shall be ASTM C 1085.

2.4.4 PREFORMED

Preformed sealant shall be polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealant capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 30 to plus 160 degrees F, the sealant shall be non-bleeding and shall have no loss of adhesion.

2.4.4.1 Foam Strip

Type J Foam strip shall be capable of sealing out moisture, air, and dust when installed and compressed as recommended by the manufacturer. Service temperature shall be minus 40 to plus 275 degrees F. Untreated strips shall be furnished with adhesive to hold them in place. Adhesive shall not stain or bleed into adjacent finishes. Treated strips shall be saturated with butylene waterproofing or impregnated with asphalt.

2.5 SOLVENTS AND CLEANING AGENTS

Solvents, cleaning agents, and accessory materials shall be provided as

recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Surface Preparation

The surfaces of joints to receive sealant or caulk shall be free of all frost, condensation and moisture. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant.

Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

3.2 APPLICATION

3.2.1 Masking Tape

Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

3.2.2 Backing

Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

3.2.3 Bond-Breaker

Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

3.2.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

3.2.5 Sealant

Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Joints shall be sealed as detailed in the drawings. Sealant shall be forced into joints with sufficient pressure to expel air and fill the groove solidly. Sealant shall be installed to the indicated depth without displacing the backing. Unless otherwise indicated, specified, or recommended by the manufacturer, the installed sealant shall be dry tooled to produce a uniformly smooth surface free of wrinkles and to ensure full adhesion to the sides of the joint; the use of solvents, soapy water, etc., will not be allowed. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

3.3 CLEANING

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

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SECTION 08110

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A250.3	(1999) Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames
ANSI A250.4	(1994) Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings
ANSI A250.6	(1997) Hardware on Standard Steel Doors (Reinforcement - Application)
ANSI A250.8	(1998) SDI-100 Recommended Specifications for Standard Steel Doors and Frames

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 591	(1998) Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications
ASTM A 653/A 653M	(2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation
ASTM D 2863	(1997) Measuring the Minimum Oxygen

Concentration to Support Candle-Like
Combustion of Plastics (Oxygen Index)

ASTM E 283

(1991) Rate of Air Leakage Through
Exterior Windows, Curtain Walls, and Doors
Under Specified Pressure Differences
Across the Specimen

DOOR AND HARDWARE INSTITUTE (DHI)

DHI A115

(1991) Steel Door Preparation Standards
(Consisting of A115.1 through A115.6 and
A115.12 through A115.18)

HOLLOW METAL MANUFACTURERS ASSOCIATION (HMMA)

NAAMM HMMA HMM

(1992) Hollow Metal Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80

(1999) Fire Doors and Fire Windows

NFPA 105

(1999) The Installation of Smoke-Control
Door Assemblies

NFPA 252

(1999) Standard Methods of Fire Tests of
Door Assemblies

STEEL DOOR INSTITUTE (SDOI)

SDI 105

(1998) Recommended Erection Instructions
for Steel Frames

SDI 111-B

Recommended Standard Details for Dutch
Doors

SDI 111-C

Recommended Louver Details for Standard
Steel Doors

SDI 111-F

Recommended Existing Wall Anchors for
Standard Steel Doors and Frames

SDI 113

(1979) Apparent Thermal Performance of
STEEL DOOR and FRAME ASSEMBLIES

UNDERWRITERS LABORATORIES (UL)

UL 10B

(1997) Fire Tests of Door Assemblies

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal
Procedures."

SD-02 Shop Drawings

Doors;

Frames;

Accessories

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

SD-03 Product Data

Doors;

Frames;

Accessories

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to ANSI A250.8 requirements.

[SD-04 Samples

Factory-applied enamel finish; G,RE

Where colors are not indicated, submit manufacturer's standard colors and patterns for selection.]

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap knock-down frames in bundles. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

ANSI A250.8, except as specified otherwise. Prepare doors to receive hardware specified in Section 08710, "Door Hardware." Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 1 3/4 inches thick, unless otherwise indicated.

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Heavy Duty Doors

ANSI A250.8, Level 2, physical performance Level B, Model 2, with core construction as required by the manufacturer for exterior doors, of

size(s) and design(s) indicated.

2.2 INSULATED STEEL DOOR SYSTEMS

Insulated steel doors shall have a core of polyurethane foam and an R factor of 10.0 or more (based on a k value of 0.16); face sheets, edges, and frames of galvanized steel not lighter than 23 gage, 16 gage, and 16 gage respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Doors and frames shall receive phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Doors shall have been tested in accordance with ANSI A250.4 and shall have met the requirements for Level C. Prepare doors to receive hardware specified in Section 08710, "Door Hardware." Doors shall be 1 3/4 inches thick.

2.3 ACCESSORIES

2.3.1 Louvers

2.4 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI 113 and shall conform to:

- b. Rigid Polystyrene Foam Board: ASTM C 578, Type I or II; or

2.5 STANDARD STEEL FRAMES

ANSI A250.8, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners or knock-down field-assembled corners. Provide steel frames for doors, mullions, casework openings, unless otherwise indicated.

2.5.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

2.5.2 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

2.5.3 Mullions

Mullions shall be closed or tubular construction and shall member with heads and jambs butt-welded thereto or knock-down for field assembly. Bottom of door mullions shall have adjustable floor anchors and spreader connections.

2.5.4 Stops and Beads

Form stops and beads from 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 12 to 16 inches on centers. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

2.5.5 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

2.5.6 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

2.5.6.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

- a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire, adjustable or T-shaped;
- b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding;
- c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI 111-F; and

2.6 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in ANSI A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of ANSI A250.8 and ANSI A250.6. For additional requirements refer to DHI A115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of ANSI A250.8, as applicable. Punch door frames, with the exception of frames that will have weatherstripping or gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.7 FINISHES

2.7.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in

ANSI A250.8.

2.7.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate scheduled doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A 924/A 924M and ASTM A 653/A 653M. The Coating weight shall meet or exceed the minimum requirements for coatings having 0.4 ounces per square foot, total both sides, i.e., A40. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in ANSI A250.8. 2.7.3 Factory-Applied Enamel Finish

Coatings shall meet test procedures and acceptance criteria in accordance with ANSI A250.3. After factory priming, apply two coats of low-gloss enamel to exposed surfaces. Separately bake or oven dry each coat. Drying time and temperature requirements shall be in accordance with the coating manufacturer's recommendations. Color(s) of finish coat shall be as indicated and shall match approved color sample(s).

]2.8 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. Design frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive calking compound.

2.8.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames with mortar. When an additive is provided in the mortar, coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

3.1.2 Doors

Hang doors in accordance with clearances specified in ANSI A250.8. After erection and glazing, clean and adjust hardware.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

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SECTION 09650

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SECTION 09650

RESILIENT FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2240	(2002) Rubber Property - Durometer Hardness
ASTM D 4078	(1992; R 1996) Water Emulsion Floor Polish
ASTM E 648	(2000) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM E 662	(2001) Specific Optical Density of Smoke Generated by Solid Materials
ASTM F 510	(1993; R 1999) Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method
ASTM F 1066	(1999) Vinyl Composition Floor Tile
ASTM F 1303	(1999) Sheet Vinyl Floor Covering with Backing
ASTM F 1344	(2000) Rubber Floor Tile
ASTM F 1700	(1999) Solid Vinyl Floor Tile
ASTM F 1913	(1998) Vinyl Sheet Floor Covering Without Backing

1.2 FIRE RESISTANCE REQUIREMENTS

Flooring in corridors and exits shall have a minimum average critical radiant flux of 0.22 watts per square centimeter when tested in accordance with ASTM E 648. The smoke density rating shall be less than 450 when tested in accordance with ASTM E 662.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section

01330 SUBMITTAL PROCEDURES:

;
;

SD-03 Product Data

Sheet Flooring;
Accessories for Sheet Vinyl;

Adhesive for Sheet Vinyl;

Adhesive for Wall Base;

Manufacturer's descriptive data and installation instructions including cleaning and maintenance instructions.

SD-04 Samples

Sheet Flooring; G,RE,

Wall Base; G,RE,

Three samples of each indicated color and type of flooring and base. Sample size shall be minimum 2-1/2 x 4 inches.

SD-08 Manufacturer's Instructions

Tile Flooring;

Copies of flooring manufacturer's recommended installation procedures.

SD-10 Operation and Maintenance Data

Data Package 1; G,

Data Package in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers bearing the manufacturer's name, brands, stock names, production run, project identification, and handling instructions. Materials shall be stored in a clean dry area with temperature maintained above 70 degrees F for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations. Materials shall be protected from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Do not open containers until materials are to be

used, except for inspection to verify compliance with requirements.

1.5 ENVIRONMENTAL REQUIREMENTS

a. Areas to receive resilient flooring shall be maintained at a temperature above 70 degrees F and below 100 degrees F for 2 days before application, during application and 2 days after application . A minimum temperature of 55 degrees F shall be maintained thereafter.

b. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

1.6 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

1.8 EXTRA MATERIALS

Extra flooring material of each color and pattern shall be furnished at the rate of 5 square feet for each 1000 square feet of sheet flooring installed. Extra materials shall be from the same lot as those installed. Extra base material composed of 20 linear feet of each color shall be furnished. All extra materials shall be packaged in original containers, properly marked.

PART 2 PRODUCTS

2.1 UNDERLAYMENT

Underlayment shall be latex type, as recommended by flooring manufacturer. Wood and hardboard underlayments are specified in Section 06100N ROUGH CARPENTRY.

2.2.2 Adhesive for Wall Base

Adhesive for wall base shall be emulsified acrylic latex; non-flamable.

2.3 SHEET FLOORING

2.3.1 Vinyl Style

Sheet vinyl flooring shall be composed of a homogeneous, vinyl composition formulated without asbestos. Flooring shall be not less than 72 inches wide. Sheet vinyl flooring with backing shall conform to ASTM F 1303, Type II, Grade 1 filled sheet with inorganic or filled fibrous composition backing (minimum wear layer thickness 0.050 inches and minimum overall thickness 0.080 inches) . High quality vinyl welding rods for heat welding of joints shall be provided, as required.

2.3.1.1 Style A; Heat-Sealed, Rolls

Sheet vinyl flooring without backing shall meet the composition, flexibility, indentation, and the solvent resistance requirements of ASTM F 1913. The solid vinyl color and pattern shall extend through the total thickness of the material.

- a. Size and Thickness: Roll width 48 inches minimum; overall thickness 0.085 inch; wear layer shall be a single layer with through pattern only, not embossed.
- b. Wear Resistance: Maximum total volume loss of 0.05 cc when tested for 1,000 revolutions in accordance with ASTM F 510.
- c. Dimensional Stability: No requirements, except appropriateness for intended purpose.
- d. Chemical Composition: Polyvinyl chloride resin and plasticizer, and stabilizer, 65 percent minimum; colored pigments and fillers, 35 percent maximum. Stabilization against heat and light deterioration is required; protective coating is acceptable.
- e. Pattern: Mottled or directionally veined or flecked.<

2.3.1.2 Seaming Bead

Provide seaming bead of same material as sheet vinyl flooring and as recommended by flooring manufacturer in conjunction with Style A. Color will be selected from manufacturer's standard color.

2.3.2 Adhesive for Sheet Vinyl

Adhesive for flooring and wall base shall be as recommended by the flooring manufacturer. When manufacturer allows option between epoxy-based adhesive and other types, use epoxy-based.

2.3.2.1 Seam Sealing

As recommended by sheet flooring manufacturer.

2.3.2.2 Flooring

As recommended by flooring manufacturer to suit material and substrate conditions. When manufacturer allows option between epoxy-based adhesive and other types, use epoxy-based.

2.3.2.3 Wall Base

As recommended by wall base manufacturer.

2.3.3 Accessories for Sheet Vinyl

2.3.3.1 Cleaner and Polish

As recommended in flooring manufacturer's printed maintenance instructions.

2.4 STRIPS

2.4.1 Edge

Provide aluminum or other nonferrous metal and approved by flooring manufacturer. Limit vertical lips in edge strips to 1/4 inch; limit total rise to 1/2 inch.

2.5 WALL BASE

Base shall be manufacturers standard rubber or vinyl, coved style (installed with resilient flooring) . Base shall be 4 inches high and a minimum 1/8 inch thick, in black , and in matte finish. Preformed outside corners shall be furnished. Use flexible base to conform to irregularities in walls, partitions, and floors. Provide premolded corners in matching size, shape, and color for all right-angle inside and outside corners.

2.6 POLISH/FINISH

Polish shall conform to ASTM D 4078. Use flooring manufacturer's standard high-solids finish for shine without buffing; non-flamable; compatible with factory-applied finish; may be buffed or burnished for maximum gloss.

2.7 CAULKING AND SEALANTS

Caulking and sealants shall be in accordance with Section 07900A JOINT SEALING.

2.8 MANUFACTURER'S COLOR AND TEXTURE

Color and distinct pattern shall be uniformly distributed throughout thickness of tile. Color and texture shall be as approved by the contracting officer. Flooring in continuous area or replacement of damaged flooring in continuous area shall be from same production run with same shade and pattern,

PART 3 EXECUTION

3.1 GENERAL APPLICATION REQUIREMENTS

To avoid damage, install flooring after other work in same area has been completed. Apply flooring and accessories in accordance with manufacturer's directions, using experienced workers. Detailed requirements follow:

a. Adhesives: Do not allow smoking, open flames or other sources of ignition in area where solvent-containing adhesives are being used or spread, after posting conspicuous signs reading "NO SMOKING OR OPEN FLAME".

b. Flooring: Apply in patterns indicated. Start in center of room or area, and work toward edges. Keep tile lines and joints square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary width of edge tiles as necessary to maintain full-size tiles in field, but no edge tile shall be less than one-half full size, except where irregular-shape makes it impossible.

c. Cutting: Cut flooring edges and scribe to walls and partitions after field flooring has been applied.

d. Edge Strips: Provide edging strips where flooring terminates at points higher than contiguous finished flooring, except where

thresholds are provided. [Anchor metal strips to concrete floor surfaces by countersunk screws into metal or fiber expansion sleeves.] [Secure plastic strips with adhesive.]

3.2 INSTALLATION OF SHEET VINYL FLOORING

Sheet vinyl flooring shall be installed with adhesive mixed and applied in accordance with the manufacturer's written installation instructions; adhesive shall be full coverage. Flooring shall be fitted to the room with minimum of seams by hand cutting, straight scribing, or pattern scribing as necessary to suit job conditions. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Reverse rolls, as indicated by manufacturer, for specific patterns, to butt sides to themselves, and match color and pattern. Seams shall be cut by overlapping or underscribing as recommended by the manufacturer. Seams and edges of sheet vinyl flooring in room areas shall be bonded or welded as recommended by the manufacturer. Roll with three-section, minimum 100 pound roller starting at middle of sheet to expel trapped air and to thoroughly embed flooring material.

3.2.1 Sealing at Seams

Cut and seal seams as recommended by flooring manufacturer. Roll seams thoroughly, and weight with sandbags to ensure complete adhesion.

3.2.2 Heat Seaming

Provide heat-sealed seaming bead at each joint in flooring and between flooring and integral base. Construct seams using tools, materials, methods, and sequence of work in conformance with written instructions of flooring manufacturer. Finish joints flush, free from voids, recesses, and raised areas.

3.3 INSTALLATION OF WALL BASE

Wall base shall be installed with adhesive in accordance with the manufacturer's written instructions. Base joints shall be tight and base shall be even with adjacent resilient flooring. Voids along the top edge of base at masonry walls shall be filled with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

3.4 CLEANING

Immediately upon completion of installation of tile in a room or an area, flooring and adjacent surfaces shall be dry-cleaned to remove all surplus adhesive. No sooner than 5 days after installation, flooring shall be washed with a nonalkaline cleaning solution, rinsed thoroughly with clear cold water, and, except for raised pattern rubber flooring, rubber tile and sheet rubber flooring, rubber stair treads, and static control vinyl tile, given two coats of polish in accordance with manufacturers written instructions. Raised pattern rubber flooring, rubber tile and sheet rubber flooring, rubber stair treads, and static control vinyl tile shall be cleaned and maintained as recommended by the manufacturer.

a. Vinyl flooring, except prewaxed flooring and flooring designated as no-wax or never-wax by manufacturer, shall have two coats of polish applied and each coat buffed to an even luster with an electric

polishing machine, using a lamb's wool pad when dry buffing.

b. Translucent or transparent-surfaced sheet vinyl flooring shall be cleaned by damp mopping. Do not buff finish. Follow flooring manufacturer's cleaning and maintenance instructions.

3.5 PROTECTION

From the time of laying until acceptance, flooring shall be protected from damage as recommended by the flooring manufacturer. Flooring which becomes damaged, loose, broken, or curled and cove base which is not tight to backing fillet shall be removed and replaced.

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SECTION 09900

PAINTS AND COATINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH Limit Values	(1991-1992) Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
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ACGIH TLV-DOC	Documentation of Threshold Limit Values and Biological Exposure Indices
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AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A13.1	Scheme for Identification of Piping Systems
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 235	Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
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ASTM D 523	(1999) Standard Test Method for Specular Gloss
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ASTM C 669	(1995) Glazing Compounds for Back Bedding and Face Glazing of Metal Sash
------------	--

ASTM C 920	(1998) Elastomeric Joint Sealants
------------	-----------------------------------

ASTM D 2092	(1995) Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting
-------------	--

ASTM D 4214	(1998) Evaluating the Degree of Chalking of Exterior Paint Films
-------------	--

ASTM D 4263	(1983; R 1999) Indicating Moisture in Concrete by the Plastic Sheet Method
-------------	--

ASTM D 4444	(1998) Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters
-------------	---

ASTM F 1869	(1998) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous
-------------	--

Calcium Chloride

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.1000	Air Contaminants
29 CFR 1910.1001	Asbestos, Tremolite, Anthophyllite, and Actinolite
29 CFR 1910.1025	Lead
29 CFR 1926.62	Lead Exposure in Construction

FEDERAL STANDARDS (FED-STD)

FED-STD-313	(Rev. C) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities
FED-STD-595	(1989 Rev B) Color

MASTER PAINTERS INSTITUTE (MPI)

MPI 9	(2001) Exterior Alkyd Enamel
MPI 10	(2001) Exterior Latex, Flat
MPI 11	(2001) Exterior Latex, Semi-Gloss
MPI 23	(2001) Surface Tolerant Metal Primer
MPI 44	Interior Latex, Gloss Level 2
MPI 45	(2001) Interior Primer Sealer
MPI 46	(2001) Interior Enamel Undercoat
MPI 47	(2001) Interior Alkyd, Semi-Gloss

MPI 48	(2001) Interior Alkyd, Gloss
MPI 49	(2001) Interior Alkyd, Flat
MPI 50	(2001) Interior Latex Primer Sealer
MPI 51	(2001) Interior Alkyd, Eggshell
MPI 52	(2001) Interior Latex, Gloss Level 3
MPI 54	(2001) Interior Latex, Semi-Gloss
MPI 56	(2001) Interior Alkyd Dry Fog/Fall
MPI 57	(2001) Interior Oil Modified Clear Urethane, Satin
MPI 59	(2001) Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss
MPI 60	(2001) Interior/Exterior Latex Porch & Floor Paint, Low Gloss
MPI 68	(2001) Interior/Exterior Latex Porch & Floor Paint, Gloss
MPI 71	(2001) Polyurethane, Moisture Cured, Clear, Flat
MPI 72	(2001) Polyurethane, Two Component, Pigmented, Gloss
MPI 94	(2001) Exterior Alkyd, Semi-Gloss
MPI 95	(2001) Fast Drying Metal Primer
MPI 101	(2001) Cold Curing Epoxy Primer
MPI 107	(2001) Rust Inhibitive Primer (Water-Based)
MPI 110	(2001) Interior/Exterior High Performance Acrylic
MPI 119	(2001) Exterior Latex, High Gloss (acrylic)
MPI 134	(2001) Waterborne Galvanized Primer
MPI 138	(2001) High Performance Latex, White and Tints - MPI Gloss Level 2

MPI 139	(2001) High Performance Latex, White and Tints - MPI Gloss Level 3
MPI 140	(2001) High Performance Architectural Latex - Gloss Level 4
MPI 141	(2001) High Performance Semigloss Latex, White and Tints - Gloss Level 5
MPI 144	(2001) Institutional Low Odor / VOC Interior Latex, Gloss Level 2
MPI 145	(2001) Institutional Low Odor / VOC Interior Latex, Gloss Level 3
MPI 146	Institutional Low Odor/VOC Interior Latex - Gloss Level 4 (a 'satin-like' finish)
MPI 147	(2001) Institutional Low Odor / VOC Interior Latex, Gloss Level 5

COMMERCIAL ITEM DESCRIPTION (CID)

CID A-A-2904	Thinner, Paint, Mineral Spirits, Regular and Odorless
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SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS-EPP-SP01-01	(2001) Environmentally Preferable Product Specification for Architectural and Anti-Corrosive Paints
-----------------	---

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC PA 1	(2000) Shop, Field, and Maintenance Painting
SSPC PA 3	(1995) Safety in Paint Application
SSPC VIS 1	(1989) Visual Standard for Abrasive Blast Cleaned Steel (Standard Reference Photographs)
SSPC VIS 3	(1993) Visual Standard for Power- and Hand-Tool Cleaned Steel (Standard Reference Photographs)
SSPC VIS 4	(2001) Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting
SSPC SP 1	(1982) Solvent Cleaning
SSPC SP 2	(1995) Hand Tool Cleaning

SSPC SP 3	(1995) Power Tool Cleaning
SSPC SP 6	(1994) Commercial Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

In keeping with the intent of Executive Order 13101, "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition", products certified by SCS as meeting SCS-EPP-SP01-01 shall be given preferential consideration over registered products. Products that are registered shall be given preferential consideration over products not carrying any EPP designation.

SD-02 Shop Drawings

Piping identification

Submit color stencil codes

SD-03 Product Data

Coating; G, RE

Manufacturer's Technical Data Sheets

[Sealant]

SD-04 Samples

Color; G, RE

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated.

[

]

SD-07 Certificates

Applicator's qualifications

Qualification Testing laboratory for coatings G, RE

SD-08 Manufacturer's Instructions

Application instructions

Mixing

Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

Manufacturer's Material Safety Data Sheets

Submit manufacturer's Material Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

SD-10 Operation and Maintenance Data

Coatings: G, RE

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

1.3 APPLICATOR'S QUALIFICATIONS

[1.3.1 Contractor Qualification

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on a minimum of three similar projects within the past three years. List information by individual and include the following:

- a. Name of individual and proposed position for this work.
- b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address, telephone number, and telex number (if non-US) of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

1.3.2 SSPC QP 1 Certification

All contractors and subcontractors that perform surface preparation or coating application shall be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of SSPC QP 1 prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting contractors and painting subcontractors must remain so certified for the duration of the project. If a contractor's or subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in contractor certification status.

1.4 QUALITY ASSURANCE

1.4.1 Field Samples and Tests

The Contracting Officer may choose up to two coatings that have been delivered to the site to be tested at no cost to the Government. Take samples of each chosen product as specified in the paragraph "Sampling Procedures." Test each chosen product as specified in the paragraph "Testing Procedure." Products which do not conform, shall be removed from the job site and replaced with new products that conform to the referenced specification. Testing of replacement products that failed initial testing shall be at no cost to the Government.

Another required testing is Batch Quality Conformance Testing to prove conformance of the manufacturer's paint to the specified MPI standard. This testing is accomplished before the materials are delivered to the job site. Provide testing for paint products. Test paint products as specified in the paragraph "Testing Procedure".

1.4.1.1 Sampling Procedure

The Contracting Officer will select paint at random from the products that have been delivered to the job site for sample testing. The Contractor shall provide one quart samples of the selected paint materials. The samples shall be taken in the presence of the Contracting Officer, and labeled, identifying each sample. Provide labels in accordance with the paragraph "Packaging, Labeling, and Storage" of this specification.

1.4.1.2 Testing Procedure

Provide Batch Quality Conformance Testing for specified products, as defined by and performed by MPI. As an alternative to Batch Quality Conformance Testing, the Contractor may provide Qualification Testing for specified products above to the appropriate MPI product specification, using the third-party laboratory approved under the paragraph "Qualification Testing" laboratory for coatings. The qualification testing lab report shall include the backup data and summary of the test results. The summary shall list all of the reference specification requirements and the result of each test. The summary shall clearly indicate whether the tested paint meets each test requirement. Note that Qualification Testing may take 4 to 6 weeks to perform, due to the extent of testing required.

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that employees performing testing are qualified. If the Contractor chooses MPI to perform the Batch Quality Conformance testing, the above submittal information is not required, only a letter is required from the Contractor stating that MPI will perform the testing.

1.5 REGULATORY REQUIREMENTS

1.5.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.5.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.5.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.5.4 Asbestos Content

Materials shall not contain asbestos.

1.5.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.5.6 Silica

Abrasive blast media shall not contain free crystalline silica.

1.5.7 Human Carcinogens

Materials shall not contain ACGIH Limit Values and ACGIH TLV-DOC confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.6 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with

sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F.

1.7 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01525, "Safety Requirements" and in Appendix A of EM 385-1-1. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.7.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA 3.

1.7.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
- b. 29 CFR 1910.1000.
- c. ACGIH Limit Values, threshold limit values.
- [d. The appropriate OSHA standard in 29 CFR 1910.1025 and 29 CFR 1926.62 for surface preparation on painted surfaces containing lead. Removal and disposal of coatings which contain lead is specified in [Section 13281A, "Lead Hazard Control Activities"] [Section 13282N, "Lead in Construction"] [Section 13283N, "Removal/Control and Disposal of Lead Paint]." Additional guidance is given in SSPC Guide 6 and SSPC Guide 7. Refer to drawings for list of hazardous materials located on this project. Contractor to coordinate paint preparation activities with this specification section.
-]e. The appropriate OSHA standards in 29 CFR 1910.1001 for surface preparation of painted surfaces containing asbestos. Removal and disposal of coatings which contain asbestos materials is specified in Section 13281, "Engineering Control of Asbestos Containing Materials." Refer to drawings for list of hazardous materials located on this project. Contractor to coordinate paint preparation activities with this specification section.

]1.8 ENVIRONMENTAL CONDITIONS

1.8.1 Coatings

Do not apply coating when air or substrate conditions are:

- a. Less than 5 degrees F above dew point;
- b. Below 50 degrees F or over 95 degrees F, unless specifically

pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

1.9 COLOR SELECTION

Colors of finish coats shall be as indicated or specified. Where not indicated or specified, colors shall be selected by the Contracting Officer. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

Tint each coat progressively darker to enable confirmation of the number of coats.

Color, texture, and pattern of wall coating systems shall be as indicated on drawings..

1.10 LOCATION AND SURFACE TYPE TO BE PAINTED

1.10.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

- a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.
- b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.
- c. Existing coated surfaces that are damaged during performance of the work.

1.10.1.1 Exterior Painting

Included are existing coated surfaces made bare by cleaning operations. Field painting of new coated surfaces that are damaged during performance of the work.

1.10.1.2 Interior Painting

Field painting of new coated surfaces that are damaged during performance of the work.

1.10.2 Painting Excluded

Do not paint the following unless indicated otherwise.

- a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.
- b. Surfaces in concealed spaces. Concealed spaces are defined as

enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.

- c. Steel to be embedded in concrete.
- d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.
- e. Hardware, fittings, and other factory finished items.

1.10.3 Mechanical and Electrical Painting

Includes field coating of interior and exterior new surfaces.

- a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.
 - (1) Exposed piping, conduit, and ductwork;
 - (2) Supports, hangers, air grilles, and registers;
 - (3) Miscellaneous metalwork and insulation coverings.

1.10.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes. Clean the surfaces to remove dust, dirt, rust, and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat primer per schedules. Shield sprinkler heads with protective covering while painting is in progress. Upon completion of painting, remove protective covering from sprinkler heads. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Provide primed surfaces with the following:

- a. Piping in Unfinished Areas: Provide primed surfaces with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material. In lieu of red enamel finish coat, provide piping with 2 inch wide red enamel bands or self-adhering red plastic bands spaced at maximum of 20 foot intervals.
- b. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 1.0 mil. Provide piping with 2 inch wide red enamel bands or self-adhering red plastic bands spaced at maximum of 20 foot intervals throughout the piping systems.

1.10.3 MISCELLANEOUS PAINTING

Lettering

Lettering shall be provided as scheduled on the drawings, shall be block type, and shall be black enamel. Samples shall be approved before application.

1.10.4 Definitions and Abbreviations

1.10.4.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

1.10.4.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing shall only be accomplished by MPI testing lab.

1.10.4.3 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (metals, plastics, wood, paper, leather, cloth, etc.). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendering, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

1.10.4.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.10.4.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five (5) levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

1.10.4.6 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

1.10.4.7 EXT

MPI short term designation for an exterior coating system.

1.10.4.8 INT

MPI short term designation for an interior coating system.

1.10.4.9 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

1.10.4.10 mil / mils

The English measurement for 0.001 in or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

1.10.4.11 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

1.10.4.12 MPI Gloss Levels

MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with ASTM D 523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

1.10.4.13 MPI System Number

The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.

1.10.4.14 Paint

See Coating definition.

1.10.4.15 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.10.4.16 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.2.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

- a. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, ASTM D 235. Allow surface to dry. Wiping shall immediately precede the application of the first coat of any coating, unless specified otherwise.
- b. Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.
- c. The requirements specified are minimum. Comply also with the application instructions of the paint manufacturer.
- d. Previously painted surfaces ordamaged during construction shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter.
- e. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed.

- f. Chalk shall be removed so that when tested in accordance with ASTM D 4214, the chalk resistance rating is no less than 8.
- g. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas.
- h. Edges of chipped paint shall be feather edged and sanded smooth.
- i. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting.
- j. New, proposed coatings shall be compatible with existing coatings.

3.2.2 Existing Coated Surfaces with Minor Defects

Sand, spackle, and treat minor defects to render them smooth. Minor defects are defined as scratches, nicks, cracks, gouges, spalls, alligatoring, chalking, and irregularities due to partial peeling of previous coatings.]

3.2.3 Removal of Existing Coatings

Remove existing coatings from the following surfaces:

- a. Surfaces containing large areas of minor defects;
- b. Surfaces containing more than 20 percent peeling area; and
- c. Surfaces designated by the Contracting Officer, such as surfaces where rust shows through existing coatings.

3.2.4 Substrate Repair

- a. Repair substrate surface damaged during coating removal;
- b. Sand edges of adjacent soundly-adhered existing coatings so they are tapered as smooth as practical to areas involved with coating removal; and
- c. Clean and prime the substrate as specified.

3.5 PREPARATION OF METAL SURFACES

3.3 Existing and New Ferrous Surfaces

- a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances:
Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2, SSPC SP 3, SSPC SP 6, or [SSPC SP 10.
Brush-off blast remaining surface in accordance with SSPC SP 7;
Water jetting to SSPC SP 12 WJ-4 may be used to remove loose coating and other loose materials. Use inhibitor as recommended by coating manufacturer to prevent premature rusting. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

- b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 6/SSPC SP 12 WJ-3SSPC SP 10/SSPC SP 12 WJ-2.

3.4 Final Ferrous Surface Condition:

For tool cleaned surfaces, the requirements are stated in SSPC SP 2 and SSPC SP 3. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 3.

For abrasive blast cleaned surfaces, the requirements are stated in SSPC SP 7, SSPC SP 6, and SSPC SP 10. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 1.

For waterjet cleaned surfaces, the requirements are stated in SSPC SP 12. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 4.

3.5.3 Galvanized Surfaces

- a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution in accordance with SSPC SP 1. If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brush-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized" If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D 2092, Appendix X2, and remove by one of the methods described therein.
- b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to SSPC SP 12 WJ3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.

3.5 APPLICATION

3.5.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated.

Paints, except water-thinned types, shall be applied only to surfaces that

are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

Apply paint to new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. For piping in unfinished spaces, provide primed surfaces with one coat of red alkyd gloss enamel to a minimum dry film thickness of 1.0 mil. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. For piping in finished areas, provide prime surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel. Upon completion of painting, remove protective covering from sprinkler heads.

- a. **Drying Time:** Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.
- b. **Primers, and Intermediate Coats:** Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.
- c. **Finished Surfaces:** Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.
- d. **Thermosetting Paints:** Topcoats over thermosetting paints (epoxies and urethanes) should be applied within the overcoating window recommended by the manufacturer.
- e. **Floors:** For nonslip surfacing on level floors, as the intermediate coat is applied, cover wet surface completely with almandite garnet, Grit No. 36, with maximum passing U.S. Standard Sieve No. 40 less than 0.5 percent. When the coating is dry, use a soft bristle broom to sweep up excess grit, which may be reused, and vacuum up remaining residue before application of the topcoat.

3.5.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than 0.125 L of suitable thinner per liter. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.5.3 Coating Systems

- a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table

Division 5. Exterior Metal, Ferrous and Non-Ferrous Paint Table

Division 5. Interior Metal, Ferrous and Non-Ferrous Paint Table

- b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.
- c. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.
- d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:
 - (1) One coat of primer.
 - (2) One coat of undercoat or intermediate coat.
 - (3) One topcoat to match adjacent surfaces.
- e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.6 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

- a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.
- b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.
- c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
- d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.
- e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.
- f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.7 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with ANSI A13.1. Place stenciling in clearly visible locations.

On piping not covered by ANSI A13.1], stencil approved names or code letters, in letters a minimum of 1/2 inch high for piping and a minimum of 2 inches high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

3.8 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.9 PAINT TABLES

All DFT's are minimum values.

3.9.1 EXTERIOR PAINT TABLES

DIVISION 5: EXTERIOR METAL, FERROUS PAINT TABLE

STEEL / FERROUS SURFACES

A. New Steel that has been hand or power tool cleaned to SSPC SP 2 or SSPC SP 3. Field paint new coated surfaces that are damaged during performance of the work.

1. Alkyd

New; MPI EXT 5.1Q-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 23	MPI 94	MPI 94
System DFT: 5.25 mils		

New; MPI EXT 5.1Q-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 23	MPI 9	MPI 9
System DFT: 5.25 mils		

B. New Steel that has been blast-cleaned to SSPC SP 6. Field paint new coated surfaces that are damaged during performance of the work.

1. Alkyd

New; MPI EXT 5.1D-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 94	MPI 94
System DFT: 5.25 mils		

New; MPI EXT 5.1D-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 9	MPI 9
System DFT: 5.25 mils		

C. New steel blast cleaned to SSPC SP 10:

1. Waterborne Light Industrial

MPI EXT 5.1R-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 101	MPI 108	MPI 110-G5
System DFT: 8.5 mils		

MPI EXT 5.1R-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 101	MPI 108	MPI 110-G6
System DFT: 8.5 mils		

STEEL / FERROUS SURFACES

2. Pigmented Polyurethane

MPI EXT 5.1J-G6 (Gloss)

Primer:

Intermediate:

Topcoat:

MPI 101

MPI 108

MPI 72

System DFT: 8.5 mils

3.9.2 INTERIOR PAINT TABLES

DIVISION 5: INTERIOR METAL, FERROUS PAINT TABLE

INTERIOR STEEL / FERROUS SURFACES

- A. Metal, Mechanical, Electrical, Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, Surfaces adjacent to painted surfaces (Match surrounding finish), and miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Field paint new coated surfaces that are damaged during performance of the work.

1.

MPI INT 5.1R-G3 (Eggshell)		
Primer:	Intermediate:	Topcoat:
MPI 79	MPI 139	MPI 139
System DFT: 5 mils		

MPI INT 5.1R-G5 (Semigloss)		
Primer:	Intermediate:	Topcoat:
MPI 79	MPI 141	MPI 141
System DFT: 5 mils		

2.

INTERIOR STEEL / FERROUS SURFACES

MPI INT 5.1E-G3 (Eggshell)

Primer: Intermediate: Topcoat:

MPI 79 MPI 51 MPI 51

System DFT: 5.25 mils

MPI INT 5.1E-G5 (Semigloss)

Primer: Intermediate: Topcoat:

MPI 79 MPI 47 MPI 47

System DFT: 5.25 mils

MPI INT 5.1E-G6 (Gloss)

Primer: Intermediate: Topcoat:

MPI 79 MPI 48 MPI 48

System DFT: 5.25 mils

-- End of Section --

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DIVISION 10 - SPECIALTIES

SECTION 10530

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SECTION 10530

CANOPY

PART 1 GENERAL

Furnish and install prefabricated steel canopies, walkway covers, carports or special structures.

Concrete: General contractor shall block out openings in concrete slab at each column location.

1.1 QUALITY ASSURANCE

Manufacturer: Shall have a minimum of 10 years experience in the manufacture and supplying of steel canopies.

Installer- Shall have a minimum of 5 years experience installing preengineered steel canopies, Installation shall be in accordance with manufacturers shop drawings.

1.2 MOCKUP

Sample of Deck Panel and Fascia Trim

1.3 DESIGN REQUIREMENTS

The design of the canopy shall be provided by the contractor as a complete system. Members and connections not indicated on the drawings shall be designed by the Contractor. Canopy and Fascia panels, components, transitions, accessories, and assemblies shall be supplied by the same canopy system manufacturer.

1.4 Dead Loads

The dead loads shall consist of the weight of all permanent construction such as canopy, fascia, framing, covering members and all other materials of the canopy system.

1.5 Collateral Loads

Collateral load of 5 pound per square foot shall be applied to the entire structure to account for the weight of additional permanent materials other than the canopy system. This allowance does not include the weight of hung equipment weighting 50 pounds or more. Equipment loads of 50 pounds or more shall be shown on the shop (detail) drawings and the structure (frame, and other structures components) shall be strengthened as required. The Contractor is responsible for providing the building manufacturer the magnitude and approximate location of all concentrated loads greater than 50 pounds before design of the canopy commences.

1.6 Roof Live Loads

1.6.1 Uniform Loads

Uniform roof live loads, including maintenance traffic and construction loads, shall be determined and applied in accordance UFC-3-310-01.

1.6.2 Concentrated Loads

In addition to UFC-3-310-01 roof live loads, a minimum design concentrated load of 300 pounds shall be used to simulate a construction load on canopy panels. The concentrated load shall be applied at the panel midspan and shall be resisted by a single panel, or a 24 inches wide corrugated metal panel, assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.

1.7 Roof Snow Loads

The design roof snow loads, including effects of drifting, shall be determined and applied in accordance UFC-3-310-01.

1.8 Wind Loads

Wind pressures shall be computed and applied in accordance with UFC 3-310-01.

1.9 Seismic Loads

Seismic loads shall be computed in accordance with UFC 1-200-01.

1.10 Foundations

Contractor shall design column foundations based on the final geotechnical report.

1.11 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Manual	(1989) Manual of Steel Construction Allowable Stress Design
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2000a) Carbon Structural Steel
ASTM A257	(2000) Standard For Concrete Pipe
ASTM A325-02	(2000) Standard Specification for Structural Bolts, Heat Treated, 120/105 ksi Minimum tensile Strength
ASTM A 500	(Date) Specification for Structural Tubing for construction of bridges and buildings
ASTM A 653/A 653M	(2000) Steel Sheet, Zinc-Coated

(Galvanized) or Zinc-Iron Alloy-Coated
(Galvannealed) by The Hot Dip Process

Department of Defense (DOD)

UFC 1-200-01 (2000) Design: General Building
Requirements

UFC 3-310-01 (2000) Load Assumptions for Buildings

1.12 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings;G, ED

Detail Drawing consisting of catalog cuts, design and erection drawings and an isometric view of the canopy showing the design wind uplift pressure and dimension of edge and corner zones. Shop painting and finishing specifications. Anchor bolt placement plan including required footing sizes and column reactions.

SD-03 Product Data

Design Analysis;G, ED

Design analysis (Canopy, Columns, and Footing including anchor bolt plans) as one package with drawings.

SD-04 Samples

ColorG,RE

Two 2" x 3" color samples for selection of roof deck and trim.

SD-07 Certificates

Canopy and Columns

a. A certificate from the Canopy manufacture stating that the canopy and columns were designed from a complete set of the contract drawings and specifications and that the canopy and columns furnished complies with the specified requirements.

b. Mill certification for structural bolts, framing, canopy panels and fascia panels.

c. Warranty certificate. At the completion of the project the Contractor shall furnish signed copies of the one Warranty for Canopy and columns for material and workmanship.

1.13 DELIVERY STORAGE AND HANDLING

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials other than framing and structural members shall be covered with weathertight coverings and kept dry.

Storage accommodations for canopy panels and fascia panels shall provide good air circulation and protection from surface staining.

1.14 Quality Assurance

A. Manufacturer: Shall have a minimum of 10 years experience in the manufacture and supplying of steel canopies.

B. Installer: Shall have a minimum of 5 years experience installing preengineered steel canopies. Installation shall be in accordance with manufacturers shop drawings.

PART 2 PRODUCTS

2.1 STRUCTURAL COMPONENTS

2.1.1 Columns

Columns shall be Structural Steel tubing and shall conform to ASTM A500. Grade B with a minimum yield stress of 46,000 psi. Columns shall be sized to meet or exceed spec

2.1.2 Base Plate

Structural steel plate shall comply with ASTM A36 with a minimum yield stress of 36,000 psi, with 3/4" thick welded gusset as required.

2.1.3 Top Plate

Top plates shall comply with ASTM A36 structural steel plate with a minimum yield stress of 36,000 psi. Shop fabricated with pre-punched or pre-drilled bolt holes with continuously welded gussets as required.

2.1.4 Structural Framing

Structural framing shall be wide flange beams and comply with ASTM A50 Ref Id with a minimum yield stress of 50,000 psi.

2.1.5 Structural Connections

Steel plates shall comply with ASTM A36 with a minimum yield stress of 36,000 psi. All framing members shall be shop fabricated for bolted field assembly. High strength ASTM A325, "N" type bolts shall be used. Flange and purlin bracing where required.

2.1.6 Anchor Bolts

1 1/4" dia. X 44" long structural steel rod with a minimum 7", 90 degree bend shall be used and comply with ASTM A36 structural steel with a minimum yield stress of 36,000 psi. Minimum projection above footing shall be 8" of

finished threads. Double nuts and washers for each bolts shall be provided, one set to be used as levelers. Galvanized sheet metal templates for setting anchors shall be used. Templates shall be removed before setting column on foundation.

2.2 Deck Panels

Deck panels shall be 20 Ga thick 16" wide 3" steel. Panels shall comply with ASTM A653 with a minimum yield stress of 40,000 psi having a G60 galvanized surface meeting ASTM A257. Panels are fastened to the wide flange purlin beams as required. No splicing of deck panels will be allowed. Panel shall have a factory finish side coated with a full coat polyester paint baked on over an epoxy primer. Panel to be roll formed in sufficient length to avoid unnecessary center gutters.

2.3 Fascia

Standing seam vertical, 18 Ga. galvanized panels with factory finish. Fascia outriggers to be galvanized, cold formed steel angles, 20 Ga. at 4'-0" or 2'-8" on center as fascia height requires. Gutters and drains trough will be same material as deck. Drainage system through drain pipe internally mounted in canopy columns or shrouds.

2.4 Accesories

2.4.1 Gutter

Gutter shall be steel same material as deck and comply with ASTM A653 with a minimum yield stress of 43,000 psi with a G60 galvanized substrate. Gutter shall have manufacturer's factory color finish.

2.4.2 Downspout

Downspouts shall be roll formed with watertight seams. Downspout shall have manufacturer's factory color finish. Downspouts shall be one continuous length.

2.4.3 Hardware

Gutter-to-deck panel fasteners shall be self drilling, carbon steel, cadmium painted screws with an integral hex head.

2.4.4 Sealant

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable canopy and column color and shall cure to a rubber like consistency.

PART 3 EXECUTION

3.1 Inspection

Verify that canopy is installed straight and true.

3.2 Installation

Install canopy in accordance with manufacturer's drawings and specifications. Slope to be 2" on 12"

3.3 TOLERANCES

Maximum Variation From Plan or Location Indicated on Drawings: None.
Maximum Offset From True Alignment between Adjacent Members Butting or In
Line: None

-- End of Section --

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DIVISION 11 - EQUIPMENT

SECTION 11035

BULLET-RESISTANT COMPONENTS

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SECTION 11035

BULLET-RESISTANT COMPONENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500 (1994) Test Methods for Louvers, Dampers and Shutters

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum Finishes

AA SAA-46 (1978) Standards for Anodized Architectural Aluminum

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M (1997ae1) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 653/A 653M (1999) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM C 1036 (1991; R 1997) Flat Glass

ASTM C 1048 (1997b) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass

ASTM C 1172 (1996e1) Laminated Architectural Flat Glass

ASTM D 256 (1997) Determining the Izod Pendulum Impact Resistance of Plastics

ASTM D 542 (1995) Index of Refraction of Transparent Organic Plastics

ASTM D 570 (1998) Water Absorption of Plastics

ASTM D 635 (1998) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

ASTM D 638 (1998) Tensile Properties of Plastics

ASTM D 638M	(1998) Tensile Properties of Plastics (Metric)
ASTM D 648	(1998c) Deflection Temperature of Plastics Under Flexural Load
ASTM D 696	(1998) Coefficient of Linear Thermal Expansion of Plastics Between Minus 30 degrees C and 30 degrees C
ASTM D 792	(1998) Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D 882	(1997) Tensile Properties of Thin Plastic Sheeting
ASTM D 905	(1998) Strength Properties of Adhesive Bonds in Shear by Compression Loading
ASTM D 1003	(1997) Haze and Luminous Transmittance of Transparent Plastics
ASTM D 1044	(1999) Resistance of Transparent Plastics to Surface Abrasion
ASTM D 1922	(1994a) Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method
ASTM D 3029	(1994) Impact Resistance of Flat Rigid Plastic Specimens by Means of a Tup (Falling Weight)
ASTM D 3595	(1997) Polychlorotrifluoroethylene (PCTFE) Extruded Plastic Sheet and Film
ASTM D 3951	(1998) Commercial Packaging
ASTM D 4093	(1995) Photoelastic Measurements of Birefringence and Residual Strains in Transparent or Translucent Plastic Materials
ASTM D 4802	(1994) Poly(Methyl Metacrylate) Acrylic Plastic Sheet
ASTM E 90	(1999) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
ASTM E 168	(1992) General Techniques of Infrared Quantitative Analysis
ASTM E 169	(1999) General Techniques of Ultraviolet-Visible Quantitative Analysis
ASTM E 204	(1998) Identification of Material by

Infrared Absorption Spectroscopy, Using
the ASTM Coded Band and Chemical
Classification Index

ASTM E 831	(1993) Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis
ASTM E 1300	(1998) Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load
ASTM F 428	(1997e1) Test Method for Intensity of Scratches on Aerospace Glass Enclosures
ASTM F 520	(1977; R 1997) Environmental Resistance of Aerospace Transparencies
ASTM F 521	(1983; R 1997e1) Bond Integrity of Transparent Laminates
ASTM F 548	(1981; R 1994e1) Test Method for Intensity of Scratches on Aerospace Transparent Plastics
ASTM F 735	(1994) Abrasion Resistance of Transparent Plastics and Coatings Using the Oscillating Sand Method
ASTM F 791	(1982; R 1996) Stress Crazeing of Transparent Plastics
ASTM F 1233	(1998) Security Glazing Materials and Systems
ASTM G 26	(1996) Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.1	(1997) Butts and Hinges
BHMA A156.4	(1992) Door Controls - Closers
BHMA A156.5	(1992) Auxiliary Locks & Associated Products
BHMA A156.8	(1994) Door Controls - Overhead Stops and Holders
BHMA A156.13	(1994) Mortise Locks & Latches
BHMA A156.16	(1997) Auxiliary Hardware
BHMA A156.18	(1993) Materials and Finishes

U.S. DEPARTMENT OF STATE (SD)

SD Std-01.01	(1993 Rev G Amended; Inx Certified)
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Prod/Mfg) Certification Standard Forced
Entry and Ballistic Resistance of
Structural Systems

DOOR AND HARDWARE INSTITUTE (DHI)

DHI A115.1 (1990) Preparation of 1-3/8" and 1-3/4"
Standard Steel Doors and Steel Frames for
Series 1000 Mortise Locks and Latches

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual (1997) Glazing Manual

H.P. WHITE LABORATORY (HPW)

HPW TP-0501.01 (1989) Ballistic Resistance of Structural
Materials (Opaque and Transparent); Test
Procedures and Acceptance Criteria

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA 810 (1987) Hollow Metal Manual; Section:
Hollow Metal Doors

NAAMM HMMA 820 (1987) Hollow Metal Manual; Section:
Hollow Metal Frames

NAAMM HMMA 830 (1987) Hollow Metal Manual; Section:
Hardware Preparation and Locations for
Hollow Metal Doors and Frames

NAAMM HMMA 840 (1987) Hollow Metal Manual; Section:
Installation and Storage of Hollow Metal
Doors and Frames

NAAMM HMMA 850 (1983) Hollow Metal Manual; Section:
Fire-Rated Hollow Metal Doors and Frames

NAAMM HMMA 862 (1987) Hollow Metal Manual; Section:
Guide Specifications for Commercial
Security Hollow Metal Doors and Frames

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (1993) Industrial Control and Systems
Controllers, Contactors, and Overload
Relays Rated Not More Than 2,000 Volts AC
or 750 Volts DC

NEMA ICS 6 (1993) Industrial Control and Systems,
Enclosures

NEMA MG 1 (1998) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999)

National Electrical Code

NFPA 80

(1999) Fire Doors and Fire Windows

NATIONAL INSTITUTE OF JUSTICE (NIJ)

NIJ Std 0108.01

(1985) Ballistic Resistant Protective
Materials

NAVAL FACILITIES ENGINEERING SERVICE CENTER (NFESC)

NFESC CR 80.025

(1980) Testing and Evaluation of Attack
Resistance and Hardening Retrofits of
Marine Barrack Construction Types to Small
Arms Multiple Impact Threat

UNDERWRITERS LABORATORIES (UL)

UL 752

(1995; Rev thru May 1998) Bullet-Resisting
Equipment

1.2 SYSTEM DESCRIPTION

1.2.1 Design Requirements

Bullet resistant components shall conform to the requirements specified for the particular items and as much as possible shall be complete assemblies by a single manufacturer.

1.2.2 Performance Requirements

All items specified shall be bullet resistant to the threat specified. Movable and operable components shall operate smoothly and freely. When a reference for performance is listed, operation shall conform to referenced requirements.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation;

Drawings containing complete wiring and schematic diagrams where appropriate and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of components and appurtenances, and relationship to other parts of work including clearances for operation and maintenance. Drawings sufficient to show conformance to all requirements, including fabrication details, sizes, thickness of materials, anchorage, finishes, hardware location and installation.

SD-03 Product Data

Bullet Resistant Components;

Manufacturer's descriptive data and installation instructions. Descriptive data shall include cleaning instructions as recommended by the plastic sheet manufacturer. Data shall include a complete list of parts and supplies, with current unit prices and supply source. Air flow calculations for louvers and louvers in doors shall be included.

Lists including schedule of all components to be incorporated in the work with manufacturer's model or catalog numbers, specification and drawing reference numbers, warranty information, threat level certified, [fire ratings,] [sound transmission coefficient ratings,] [insulation "U" value,] and number of items provided. Evidence that standard products essentially duplicate items that have been satisfactorily in use for two years or more, including name of purchasers, locations of installations, dates of installations, and service organizations.

SD-07 Certificates

Bullet Resistant Components;

Manufacturer's certificates attesting that all components conform to the requirements on drawings and in specifications. Submittal shall include testing reports from independent testing laboratories indicating conformance to regulatory requirements.

SD-10 Operation and Maintenance Data

Bullet Resistant Components; G,

Six copies of operation and six copies of maintenance manuals for the bifold doors furnished. The manuals shall be approved prior to beneficial occupancy.

1.4 STANDARD PRODUCTS

Materials and components shall be the standard products of a manufacturer regularly engaged in the manufacture of such products unless otherwise indicated and detailed on the drawings, and shall essentially duplicate items that have been in satisfactory use for at least two years prior to bid opening. Components shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site, or by the manufacturer. Where components are detailed on the drawings and do not conform to a manufacturer's standard product, components shall be constructed of manufacturer's standard materials which conform to the specified ballistic standard or test.

1.5 COMPONENT TEST REQUIREMENTS

Bullet-resistant components shall be provided at locations shown on the drawings. Bullet-resistant components where indicated shall be in accordance with UL MPSA of UL 752.

1.6 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the job site with the brand, name, and model number clearly marked thereon. All components shall be delivered, stored and handled so as not to be damaged or deformed, and in accordance with ASTM D 3951. Doors, windows, and louvers shall be handled carefully to prevent damage to the faces, edges, corners, ends, and glazing. Abraded, scarred, or rusty areas shall be cleaned, repaired, or replaced immediately upon detection. Damaged components that cannot be restored to like-new condition shall be replaced. Components and equipment shall be stored in a dry location on platforms or pallets that are ventilated adequately, free of dust, water, and other contaminants, and stored in a manner which permits easy access for inspection and handling.

1.7 WARRANTY

Manufacturer's warranty for 5 years shall be furnished for glazing materials. Warranty shall provide for replacement and installation of glazing if delamination, discoloration, or cracking, or crazing occurs.

PART 2 PRODUCTS

2.1 GENERAL

Bullet-resistant component assemblies shall be of size and type indicated and shall be provided at locations shown. All items included for exterior installation shall be designed to resist water penetration or entrapment.

2.2 ELECTRICAL WIRING

Electrical wiring and conduit shall be provided as specified in Section 16415 ELECTRICAL WORK, INTERIOR.

2.3 FINISHES

All ferrous metal components except stainless steel shall be furnished primed for painting unless indicated otherwise. Finish painting shall be in accordance with Section 09900 PAINTING, GENERAL unless otherwise indicated. Aluminum items shall be finished in standard mill finish unless otherwise specified. When anodic coatings are specified, the coatings shall conform to AA SAA-46, with coating thickness not less than that specified for protective and decorative type finish in AA DAF-45. Items to be anodized shall receive a polished satin finish pretreatment and a clear lacquer overcoat.

2.4 BULLET-RESISTANT STEEL PERSONNEL DOORS

Door/frame assemblies shall be factory fabricated units, designed to be bullet resistant to the specified threat level, and shall conform to applicable requirements of NAAMM HMMA 810, NAAMM HMMA 820, NAAMM HMMA 862, this section, and requirements indicated on drawings. Frames shall be furnished by the door fabricator. Door silencers shall be provided to cushion the impact of the door on the frame so that steel to steel contact is not made during closing. Exterior doors shall be completely weatherstripped, weatherproof, and fully insulated. Exterior doors shall close at flush top and bottom edges. Tops of doors shall be sealed against water penetration. Doors shall be sliders.

2.4.1 Door and Frame Fabrication

Special care shall be exercised during welding to prevent warping. Design of stiffeners and attachment method of interior armor plates shall be such that heat-affected areas which result from welding do not allow a potential ballistic leak in product construction. The subsurfaces shall be flat, parallel, and plumb after fabrication. Doors and frames shall be constructed of bullet-resistant steel or hollow metal with internal armoring and the completed assembly shall meet the specified regulatory requirements. Doors shall be reinforced and fully insulated in accordance with manufacturer's design. Steel door frames shall be mitered or coped and welded at the corners with all welds ground smooth. Corner assemblies shall be designed to eliminate ballistic penetrable seams. Where structural channel frames are used, stops shall be made of 1-1/2 inch by 5/8 inch bars welded or top screwed to the frame at not more than 6 inch centers. Screws shall be countersunk. Stops shall be so placed that full contact with the frame will be assured. Any necessary reinforcements shall be made and the frames shall be drilled and tapped as required for the hardware. Frame channels shall be mitered or coped and welded at corners with full penetration groove welds. Exposed welds shall be dressed smooth.

2.4.2 Preparation for Hardware

Doors and frames shall be prepared for hardware in conformance with NAAMM HMMA 830. Drilling and tapping of frames for surface applied hardware shall be performed in the field.

2.4.3 Hardware

Hardware for bullet-resistant door assembly shall be provided by the Gate House and Guard House manufacturer to ensure a complete bullet resistant assembly. Where test standard requires hardware to be tested with the door assembly, hardware shall be included in the labeling and/or test certification. Keying shall be an extension of existing keying system: BEST LOCK (7 pin). Furnish two sets of blanks keys for each lock. All locks shall be furnished with removable core cylinders. Replacement cores shall be BEST removable cores. Keys and permanent cores shall be shipped directly to The Contracting Officer.

2.4.3.1 Mortise Locks and Latchsets

Mortise lock and latchsets shall be series 1000, operational Grade 1, Security Grade 1 or 1A, functions as indicated in the Hardware Schedule, and shall conform to BHMA A156.13. Strikes for all mortise locks and latches, including deadlocks, shall conform to DHI A115.1 except strikes for security doors shall be rectangular, without lip. Mortise-type locks and latches for doors 1-3/4 inches thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts. Mortise locks and latches shall have full escutcheon, thru-bolted, extruded stainless steel trim.

2.4.3.2 Hinges

All 7 feet - 0 inch high doors shall be equipped with a minimum of three Grade 1 hinges in accordance with BHMA A156.1, minimum size 5 inches high, heavy, double or triple weight as required for weight of door, or a single, continuous extra-heavy-duty piano-type hinge sized to carry the weight of the door without sagging. For each additional 12 inches of door height beyond 7 feet - 0 inch, provide minimum of one more hinge shall be provided. Doors greater than 7 feet - 0 inches shall be equipped with a minimum of four hinges. Hinges shall be full mortise, half mortise, full

surface or half surface design as recommended by manufacturer for frame and door design, and shall be tamperproof or mounted on the inside face of the door. The Contractor shall provide hinge manufacturer's certification that the hinge supplied meets all applicable test requirements of BHMA A156.1, type, number of hinges specified, and that the hinge is suitable for the size and weight of the door assembly on which it will be utilized. If continuous piano-type hinges are provided with door, independent laboratory reports covering both the door weight capacity and a 2,500,000-cycle testing to match BHMA A156.1 Grade 1 requirements shall be furnished by the Contractor. Exterior door hinges shall be stainless steel.

2.4.3.3 Door Stops and Holders

Door stops shall be extra heavy duty, Type C08511 in accordance with BHMA A156.8.

2.4.4 Frame Anchors

Jamb anchors shall be provided with door/frame assembly and shall conform to manufacturer's recommendations to ensure complete bullet-resistant assemblies. Provisions shall be made to stiffen the top member of all spans over 3 feet. The bottom of the frames shall extend below the finish floorline and shall be secured to the floor slab by means of angle clips and expansion bolts. Floor clips are not required for installation in pre-built openings.

2.4.5 Weatherstripping

Head and jambs shall be provided with compression-type neoprene bulb or closed-cell neoprene adjustable-type weatherstripping. Door stops shall be weatherstripped with a surface-mounted sponge neoprene strip in bronze housing not less than 0.070 inch thick installed to make contact with the door. Weatherstripping shall be installed in conformance with the manufacturer's directions after completion of finish painting.

2.5 BULLET-RESISTANT STEEL WINDOWS

Window assemblies shall be fabricated from bullet-resistant steel shapes and bullet-resistant glazing materials specified herein; the entire assembly shall meet or exceed the specified regulatory requirements. Frames shall be welded units of sizes and shapes indicated on the drawings with minimum frame face dimensions of two inches. Windows shall be factory glazed units. Entire assembly shall be furnished by same manufacturer. Exterior (attack side) glazing stops shall be welded or integral to frame. Interior (protected side) glazing stops shall be removable stops attached with high-strength alloy steel machine screws with tamper-resistant heads.

2.5.1 Glazing Materials

Glazing material shall be factory fabricated units designed to be bullet-resistant to the specified test standard in paragraph COMPONENT TEST REQUIREMENTS. Glazing material shall be glass, with a low-spall protected (interior) face. Low-spall interior face shall meet or exceed requirements for spall resistance defined in UL 752. Glazing material shall conform to applicable requirements contained in ASTM C 1036, ASTM C 1048, and ASTM E 1300. Glazing materials shall be tested in accordance with the applicable sections of the following testing procedures: ASTM D 905, ASTM D 1003, ASTM F 428, ASTM F 548, ASTM D 4093, and ASTM F 520. All plastic glazing

exposed to the interior or exterior environment shall have an applied hardcoat.

2.5.1.1 Laminated Glass

Bullet-resistant laminated glass shall be all glass laminated construction conforming to applicable sections of ASTM C 1172. The adhesive interlayer material for bonding glass to glass shall be chemically compatible with the surfaces which are to be bonded. Materials selected for lamination purposes shall be tested in accordance with the following testing procedures: ASTM D 905, ASTM D 1044, ASTM F 735, ASTM D 4093, ASTM F 521, ASTM F 520, and ASTM D 1003. Glass plies used in the lamination shall be annealed float glass conforming to Type I, quality q3 Class 1, in accordance with ASTM C 1036 or heat-strengthened or fully heat tempered, float glass, Condition A, Type I, q3 Class 1, in accordance with ASTM C 1048.

2.5.2 Adhesive Interlayer Materials

Adhesive interlayer materials for bonding laminates (glass-glass,) shall be chemically compatible with the surfaces being bonded. Interlayer materials may be polyvinyl butyral, cast-in-place urethane, proprietary materials, sheet form urethane and other materials. Polyvinyl butyral shall not be used to bond polycarbonate. Adhesives shall be in accordance with ASTM D 905 and manufacturer's recommendations.

2.5.3 Sealants

Sealants for glazings shall be chemically compatible with the glazing materials they contact with no deleterious effects to the glazing materials or to the adhesives used in laminates. Sealants shall be in accordance with glazing manufacturer's recommendations and GANA Glazing Manual.

2.6 LABELING

Bullet-resistant equipment shall be plainly labeled in accordance with regulatory requirements. Label shall be compatible with plastic or coating. Label shall be visible only on protected side, after installation and shall include the following information:

- a. Manufacturer's name or identifying symbol
- b. Model Number, Control Number, or equivalent
- c. Date of manufacture by week, month or quarter and year. This may be abbreviated or be in a traceable code such as the lot number.
- d. Correct mounting position including threat side and secure side (by removable label on glazing material).
- e. Code indicating bullet-resistant rating and test standard used (by removable label on glazing material).

2.7 FASTENERS

Fasteners exposed to view shall match in color and finish and shall harmonize with the material to which fasteners are applied.

2.8 CORROSION PROTECTION - DISSIMILAR MATERIALS

Contact surfaces between dissimilar metals and aluminum surfaces in contact with concrete, masonry, pressure-treated wood or absorptive materials subject to wetting, shall be given a protective coating in accordance with Section 09900 PAINTING, GENERAL.

2.9 SHOP/FACTORY FINISHING

All factory or manufactured components shall be shop finished as indicated below.

2.9.1 Ferrous Metal

Surfaces of ferrous metal, except galvanized and stainless steel surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating other than a bituminous protective coating, compatible with finish coats. Prior to shop painting, surfaces shall be cleaned with solvents to remove grease and oil, and with power wire-brushing or sandblasting to remove loose rust, loose mill scale and other foreign substances. Surfaces of items to be embedded in concrete shall not be shop painted.

2.9.2 Galvanizing

Items specified to be galvanized shall be hot-dip processed after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M or ASTM A 653/A 653M as applicable.

2.9.3 Aluminum

Unless otherwise specified, aluminum items shall be standard mill finish. Anodic coatings shall conform to paragraph FINISHES.

PART 3 EXECUTION

3.1 EXAMINATION

Existing work shall be examined to ensure that it is ready for installation or erection of the components. Components shall be checked and corrected for racking, twisting, and other malformation prior to installation. Frames must be set true and plumb and remain aligned for proper installation. All surfaces and connections shall be examined for damage prior to installation.

3.2 PREPARATION AND PROTECTION

The Contractor shall field verify dimensions of rough openings for components, and shall verify that surfaces of openings are plumb, true, and provide required clearances. The Contractor shall protect surrounding work prior to installation of bullet-resistant components. Surrounding work which is damaged as a result of the installation of bullet-resistant components shall be restored to like-new condition prior to acceptance of the work described herein.

3.3 INSTALLATION

The finished work shall be rigid, neat in appearance and free from defects. Equipment shall be installed plumb and level, and secured rigidly in place. Installation of doors and frames shall conform to NAAMM HMMA 840. Doors, frames, and hardware shall be installed in strict compliance with

approved printed instructions and detail drawings provided by the manufacturer. The Contractor shall be responsible for proper installing of the door assembly so that operating clearances and bearing surfaces conform to manufacturer's instructions. Weatherstripping and thresholds shall be installed at exterior door openings to provide a weathertight installation.

All other components shall be installed in accordance with approved manufacturer's recommended instructions. All operable parts of components shall be tested for smooth, trouble-free operation, in the presence of the Contracting Officer's representative.

3.4 FRAMED INSTRUCTIONS

Framed instructions, under glass or in plastic with all edges laminated, including wiring and control diagrams showing the complete layout of each bifold door unit, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking for normal safe operation, and procedures for safely starting and stopping shall be prepared in typed form, framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing.

3.5 ELECTRICAL WORK

All electrical work shall be in accordance with Section 16415ELECTRICAL WORK, INTERIOR. Flexible connections between doors and fixed supports shall be made with extra flexible type SO cable, except in hazardous locations where wiring shall conform to NFPA 70. The cable shall have a spring-loaded automatic take up reel, or an equivalent and approved device.

3.6 ADJUSTING/CLEANING

Adjustments shall be made to doors and pass-thru drawers to assure smooth operation. Units shall be weathertight when closed and locked. All components shall be cleaned in accordance with manufacturer's instructions.

3.7 SCHEDULING

Glazing of bullet-resistant windows except factory-glazed units shall occur only after all concrete, masonry, ceiling, electrical, mechanical, plumbing and adjacent finish work has been completed to avoid damage to the glazing material. Factory-glazed windows shall be covered to protect them from damage during adjacent finish work.

-- End of Section --

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SECTION 13121A

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SECTION 13121A

METAL BUILDING SYSTEMS (MINOR REQUIREMENTS)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA Design Manual	(2000) Aluminum Design Manual: Specification & Guidelines for Aluminum Structures
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AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Manual	(1989) Manual of Steel Construction Allowable Stress Design
AISC S342L	(1993) Load and Resistance Factor Design Specification for Structural Steel Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 252	(1998) Welded and Seamless Steel Pipe Piles
ASTM A 36/A 36M	(2000a) Carbon Structural Steel
ASTM A 463/A 463M	(2000) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(1999) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 529/A 529M	(2000) High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A 53/A 53M	(2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 570/A 570M	(1998) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM A 572/A 572M	(2000a) High-Strength Low-Alloy Columbium-Vanadium Structural Steel

ASTM A 588/A 588M	(2000a) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 606	(1998) Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A 607	(1998) Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled
ASTM A 618	(1999) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A 653/A 653M	(2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 792/A 792M	(1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM B 209	(2000) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2000) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 241/B 241M	(2000) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 308/B 308M	(2000) Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B 429	(2000) Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM C 1289	(1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C 518	(1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 553	(1999) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal

Insulation

ASTM C 612	(2000) Mineral Fiber Block and Board Thermal Insulation
ASTM C 991	(1998) Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings
ASTM D 2244	(1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 4214	(1998) Evaluating Degree of Chalking of Exterior Paint Films
ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E 84	(2000a) Surface Burning Characteristics of Building Materials
ASTM E 96	(2000) Water Vapor Transmission of Materials

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(1998) Minimum Design Loads for Buildings and Other Structures
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AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(2000) Structural Welding Code - Steel
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METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA Low Rise Manual	(1996) Low Rise Building Systems Manual
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SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Arch. Manual	(1993; Errata; Addenda Oct 1997) Architectural Sheet Metal Manual
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STEEL DOOR INSTITUTE (SDOI)

SDI 100	(1991) Standard Steel Doors and Frames
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U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04	(1998) Seismic Design for Buildings
TI 809-07	(1998) Design of Cold-Formed Load Bearing Steel Systems and Masonry Veneer/Steel Stud Walls

UNDERWRITERS LABORATORIES (UL)

UL 580	(1994; Rev thru Feb 1998) Tests for Uplift
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Resistance of Roof Assemblies

UL 7520

(1995; Rev thru MAY 1998) Bullet-Resisting
Equipment

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G,RE,

Detail drawings consisting of catalog cuts, design and erection drawings.

SD-03 Product Data

Manufacturer's Instructions; G,RE,

Manufacturer's literature for individual building component systems.

Qualifications;

Qualifications of the manufacturer, and qualifications and experience of the building erector. A brief list of locations where buildings of similar design have been used shall be included with the detail drawings and shall also include information regarding date of completion, name and address of owner, and how the structure is used.

SD-07 Certificates

Metal Building Systems;

a. A Certificate from the metal building manufacturer stating that the metal building was designed in accordance with MBMA Low Rise Manual.

b. Mill certification for structural bolts, framing steel, roofing and siding, and steel wall liner panels.

c. Warranty certificate. At the completion of the project the Contractor shall furnish signed copies of the 5 year Warranty for Metal Building Roof System, a sample copy of which is attached to this section, the 20-year Manufacturer's Material Warranties, and the Manufacturer's 20-year System Weathertightness Warranty where one is required.

Insulation;

Certificate attesting that the polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

1.3 GENERAL REQUIREMENTS

The metal building system covered under this specification shall be provided by a single manufacturer and shall include all components and assemblies that form a building.

1.3.1 Building Configurations

Roof slope shall be as 6" ON 12". Buildings shall be single-span structures with one of the following framing systems: self-framing . Exterior doors windows and shall be included in the metal building system. Building shall be a manufacturer's advertised product, except that dimensions shall be not less than those indicated.

1.3.2 Qualifications

1.3.2.1 Manufacturer

Metal buildings shall be the product of a recognized steel building systems manufacturer who has been in the practice of manufacturing steel buildings for a period of not less than 5 years. The manufacturer shall be chiefly engaged in the practice of designing and fabricating metal building systems.

1.3.2.2 Installer

Erector shall have specialized experience in the erection of steel building systems for a period of at least 3 years. The erector shall furnish temporary guys and bracing where needed for squaring, plumbing, and securing the structural framing against loads acting on the exposed framing, such as wind loads and seismic forces, as well as loads due to erection equipment and erection operation. Structural members shall not be field cut or altered. Welds, abrasions, and surfaces not shop primed shall be primed after erection.

1.4 DESIGN REQUIREMENTS

Criteria and definitions shall be in accordance with MBMA Low Rise Manual, except criteria for seismic loads shall be in accordance with TI 809-04 and other loads and load combinations in accordance with ASCE 7.

1.4.1 Foundations

Foundations shall be designed for an allowable soil bearing pressure AND a minimum bottom of footing depth below finish floor elevation shall be determined by the contractor, a factor of safety of 1.5 for overturning, sliding and uplift, and a concrete compressive strength as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

1.4.2 Structural Members and Connections

Structural steel members and their connections shall be designed in accordance with AISC ASD Manual or AISC S342L. Structural cold-formed steel framing members and their connections shall be designed in accordance with TI 809-07. Framed openings shall be designed to structurally replace the covering and framing displaced.

1.4.3 Roofing and Siding Design

Steel roofing and siding shall be designed in accordance with MBMA Low Rise Manual.

1.4.4 Downspouts

Downspouts shall be designed according to the requirements of SMACNA Arch. Manual for storms which should be exceeded only once in 5 years, with adequate provision for thermal expansion and contraction.

1.5 DESIGN ANALYSIS

The Contractor shall obtain the services of a licensed Professional Engineer to design the foundations. Seismic loads shall be computed in accordance with TI 809-04 SEISMIC DESIGN FOR BUILDINGS.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials other than framing and structural members shall be covered with weathertight coverings and kept dry. Storage accommodations for roofing and siding shall provide good air circulation and protection from surface staining.

1.7 WARRANTIES

The Metal Building System (roofing, siding, and related components provided as part of the system) shall be warranted as described below against material and workmanship deficiencies, system deterioration caused by ordinary exposure to the elements and service design loads, leaks and wind uplift damage. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

1.7.1 Prime Contractor's Weathertightness Warranty

The Metal Building System shall be warranted by the Contractor on a no penal sum basis for a period of five years against materials and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The Metal Building System covered under this warranty shall include, but is not limited to, the following: framing and structural members, roofing and siding panels and seams, interior or exterior gutters and downspouts, accessories, fasteners, trim, flashings and miscellaneous building closure items such as doors and windows (when furnished by the manufacturer), connectors, components, and fasteners, and other system components and assemblies installed to provide a weathertight system; and items specified in other sections of these specifications that become part of the metal building system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's written warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and/or system manufacturer, which shall be submitted along with Contractor's warranty. However, the Contractor is ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached **WARRANTY FOR METAL BUILDING SYSTEMS**, and start upon final acceptance of the facility. The

Contractor shall provide a separate bond in an amount equal to the installed total metal building system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire metal building system as outlined above.

1.7.2 Manufacturer's Materials and System Weathertightness Warranties

The Contractor shall furnish, in writing, the following manufacturer's material warranties to the Contracting Officer which cover all Metal Building System components:

a. A manufacturer's 20 year material warranty warranting that the specified aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed securement system, including fasteners and coil material.

b. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change colors in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to replacing the defective coated material.

PART 2 PRODUCTS

2.1 FRAMING AND STRUCTURAL MEMBERS

Steel 1/8 inch or more in thickness shall conform to ASTM A 36/A 36M, ASTM A 529/A 529M, ASTM A 572/A 572M, or ASTM A 588/A 588M. Uncoated steel less than 1/8 inch in thickness shall conform to ASTM A 570/A 570M, ASTM A 606, or ASTM A 607. Galvanized steel shall conform to ASTM A 653/A 653M, G 90 coating designation, 0.045 inch minimum thickness. Aluminum-zinc coated steel shall conform to ASTM A 792/A 792M, [AZ 55] [AZ50] coating designation, 0.045 inch minimum thickness. Aluminum sheet shall conform to ASTM B 209; 0.032 inch minimum thickness. Aluminum structural shapes and tubes shall conform to ASTM B 221, or ASTM B 308/B 308M. Structural pipe shall conform to ASTM A 53/A 53M, ASTM A 252, ASTM A 500, ASTM A 501, ASTM A 618, ASTM B 221, ASTM B 241/B 241M or ASTM B 429. Holes for structural connections shall be made in the shop.

2.2 ROOFING AND SIDING

Roofing and siding shall be steel and shall have a factory color finish.

2.2.1 Roofing

Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope unless otherwise approved. Width of sheets with overlapping configurations shall provide not less than 24 inches of coverage in place or interlocking ribs shall provide not less than 12 inches of coverage in place. Panel shall have configurations for overlapping sheets. Roof deck assemblies shall be Class 90 as defined in UL 580.

Height of corrugation at overlap of adjacent roof sheets shall be the building manufacturer's standard.

2.2.2 Siding

Length of sheet shall be sufficient to cover the entire height of any unbroken height of wall surface unless otherwise approved. Width of sheets with overlapping configurations shall provide not less than 24 inches of coverage in place or interlocking ribs shall provide not less than 12 inches of coverage in place. Siding shall have configurations for overlapping adjacent sheets or interlocking ribs for securing adjacent sheets. Siding shall be fastened to framework using concealed fasteners.

2.2.3 Steel Panels

Roofing and Siding shall be zinc-coated steel conforming to ASTM A 653/A 653M, G 90 coating designation; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 55 coating; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2E5. Panels shall be 0.024 inch thick minimum.

2.2.4 Flooring

Flooring shall be a min. 11 ga. steel plate, mounted on steel tube frame with 1/4" steel anchor plates welded to floor frame with pre drilled holes for anchoring of unit. Floor to have all required cut outs for plumbing and electrical stub-ups.

2.2.5 Factory Insulated Panels

Insulated wall and roof panels shall be factory-fabricated units with insulating core between metal face sheets, securely fastened together and uniformly separated with rigid spacers, facing of steel or aluminum of composition and gauge specified for covering, constructed in a manner that will eliminate condensation on interior of panel. Panels shall have a factory color finish. Insulation shall be compatible with adjoining materials; nonrunning and nonsettling; capable of retaining its R-value for the life of the metal facing sheets; and unaffected by extremes of temperature and humidity. The assembly shall have a flame spread rating not higher than 25, and smoke developed rating not higher than 450 when tested in accordance with ASTM E 84. The insulation shall remain odorless, free from mold, and not become a source of food and shelter for insects. Panels shall be not less than 8 inches wide and shall be in one piece for unbroken wall heights. Wall panels shall meet bullet resistant as specified in Section 11035 Bullet-Resistant Components.

2.2.6 Factory Color Finish

Wall and roof panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated on the drawings. The exterior coating shall be a nominal 1 mil thickness consisting of a topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 0.2 mil thickness. The interior finish shall consist of the manufacturer's recommended thickness primer coating and finish coating.

2.2.7 Accessories

Flashing, trim, metal closure strips and curbs, fascia, caps, diverters, and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the building finish. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the roofing or siding and shall not absorb or retain water.

2.3 FASTENERS

Fasteners shall be as recommended by the manufacturer to meet the design strength requirements.

2.4 WINDOWS

Windows shall be as recommended by the manufacturer; and as specified in Section 11035 Bullet-Resistant Components.

2.5 DOORS

2.5.1 Hinged Doors

Hinged doors and frames shall receive a galvanic coating and factory primer and shall conform to the requirements of Section 08110 STEEL DOORS AND FRAMES. Exterior doors shall have top edges closed flush and sealed against water penetration. Hardware shall be as follow.

2.5.1.1 Builders, Hardware

All hardware shall be consistent. All requirements for hardware keying shall be coordinated with the Contracting Officer. The following hardware requirements are to be included.

2.5.1.2 Hinges

Exterior hinges shall have nonremovable pins and be stainless steel: grade 1 antifriction or ball bearing; and 3 each of 4-1/2" x 4-1/2" per leaf up to 3' wide. Hinges shall conform to ANSI/BHMA A156.1 and A156.7.

2.5.1.3 Locksets and Latchsets

Exterior door shall have mortise lockset conforming to ANSI/AHMA A156.13/ Series 1000, Grade 1. Lock trim shall be cast, forged or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of BHMA ANSI/BHMA A156.2 or BHMA ANSI/BHMA A156.13, roses, and escutcheons shall be 0.05 inch thick, if unreinforced. If reinforced, the outer shell shall be 0.035 inch thick and the combined thickness shall be 0.07 inch thick. All locksets and latchsets shall have lever arms in lieu of knobs. Lock cylinders shall comply with BHMA A156.5 and be compatible with Best Lock Company (seven pin). Construction cores shall be provided. All locksets shall accept same interchangeable cores.

2.5.1.4 Closer

Closer shall conform to ANSI/BHMA A156.4, Grade 1 Series C02000. Closers shall be surface-mounted, modern type, with cover. Closer for outswinging exterior door shall have parallel arm.

2.5.1.5 Architectural Door Trim

Architectural Door trim shall conform to BHMA ANSI/BHMA A156.6

2.5.1.6 Keying

Keying system shall be an extension of existing keying system: Best Lock (7 Pin). Furnish two sets of blanks keys for each lock. All locks shall be furnished with removable core cylinders. Replacement cores shall be BEST removable cores. Keys and permanent cores shall be shipped directly to the Contracting Officer.

2.5.1.7 Thresholds

Thresholds shall conform to BHMA ANSI/BHMA A156.21. Thresholds for exterior door shall be extruded aluminum of the type indicated and shall provide proper clearance and an effective seal with specified weather stripping. Where required, threshold shall be modified to receive projecting bolts of flush bolts or exir devices. Exterior doors shall be provided with aluminum threshold conforming ANSI/BHMA A156.21

2.5.1.8 Hardware Group

HW-1 (Hardware for metal door at Pre-Engineered Comm. Bldg.

3 EA.	HINGES, A8111 NRP
1 EA.	CLOSER, C02021
1 EA.	LOCKSET, F04
1 EA.	METAL THRESHOLD

2.5.2 Sliding Doors

Sliding doors shall be of the metal framed or self-framing metal type. Covering shall be of same material and finish as the siding, except that heavier gauge material shall be used if required to provide rigidity. All hardware necessary for the complete installation of the doors shall be furnished. Accessories shall include galvanized steel track, brackets, permanently lubricated dual wheel trolley hangers, operating handle, slide bolt latch assembly permitting padlocking from either inside or outside of building, and rubber or elastomeric weather stripping. Sliding door shall be as specified in Section 11035 Bullet-Resistant Components

2.6 INSULATION

Thermal resistance of insulation shall be R-19 for walls and R-28 for roof.

R-values shall be determined at a mean temperature of 75 degrees F in accordance with ASTM C 518. Roof and wall insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Insulation shall have a flame spread not in excess of 25 and a smoke developed rating not in excess of 50 when tested in accordance with ASTM E 84.

2.6.1 Rigid Board Insulation

2.6.1.1 Polyisocyanurate

Polyisocyanurate insulation shall conform to ASTM C 1289, Type I, Class 2 (having a minimum recovered material content of 5 percent by weight of core

material in the polyisocyanurate portion). For impermeable faced polyisocyanurate (Ex: aluminum foil) the maximum design R-value per 1 inch of insulation used shall be 7.2.

2.7 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubber like consistency.

2.8 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.9 SHOP PRIMING

Ferrous surfaces shall be cleaned of oil, grease, loose rust, loose mill scale, and other foreign substances and shop primed. Primer coating shall be in accordance with the manufacturer's standard system.

PART 3 EXECUTION

3.1 ERECTION

Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Improper or mislocated drill holes in panels shall be plugged with an oversize screw fastener and gasketed washer; however, panels with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces shall be kept clean and free from sealant, metal cuttings, excess material from thermal cutting, and other foreign materials. Exposed surfaces which have been thermally cut shall be finished smooth within a tolerance of 1/8 inch. Stained, discolored or damaged sheets shall be removed from the site. Welding of steel shall conform to AWS D1.1; welding of aluminum shall conform to AA Design Manual.

3.1.1 Framing Members and Anchor Bolts

Onsite flame cutting of framing members, with the exception of small access holes in structural beam or column webs, will not be permitted. Concrete work is specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Anchor bolts shall be accurately set by template while the concrete is in a plastic state. Members shall be accurately spaced to assure proper fitting of panels. As erection progresses, the work shall be securely fastened to resist the dead load and wind and erection stresses.

3.1.2 Roofing and Siding Installation

Siding shall be applied with the longitudinal configurations in the vertical position. Roofing shall be applied with the longitudinal configurations in the direction of the roof slope. Accessories shall be fastened into framing members, except as otherwise approved. Closure strips shall be provided where necessary to provide weathertight construction. Fastener and fastener spacing shall be in accordance with manufacture design.

3.1.3 Installation of Downspouts

Downspouts shall be rigidly attached to the building. Supports for downspouts shall be spaced according to manufacturer's recommendations.

3.1.4 Doors and Windows

Doors and windows, including frames and hardware, shall be securely anchored to the supporting construction, shall be installed plumb and true, and shall be adjusted as necessary to provide proper operation. Joints at doors and windows shall be sealed according to manufacturer's recommendations to provide weathertight construction.

3.2 FIELD PAINTING

Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Shop-primed ferrous surfaces exposed on the outside of the building and all shop-primed surfaces of doors and windows shall be painted with two coats of an approved exterior enamel. Factory color finished surfaces shall be touched up as necessary with the manufacturer's recommended touch-up paint.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
METAL BUILDING SYSTEM

FACILITY DESCRIPTION: _____

BUILDING NUMBER: _____

CORPS OF ENGINEERS CONTRACT NUMBER: _____

CONTRACTOR

CONTRACTOR: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

OWNER

OWNER: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

CONSTRUCTION AGENT

CONSTRUCTION AGENT: _____

ADDRESS: _____

POINT OF CONTACT: _____

—
TELEPHONE NUMBER: _____

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
METAL BUILDING SYSTEM
(continued)

THE METAL BUILDING SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY [_____] FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE AND STRUCTURAL FAILURE WITHIN PROJECT SPECIFIED DESIGN LOADS, AND LEAKAGE. THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT IS NOT LIMITED TO, THE FOLLOWING: FRAMING AND STRUCTURAL MEMBERS, ROOFING AND SIDING PANELS AND SEAMS, INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS, ACCESSORIES, TRIM, FLASHINGS AND MISCELLANEOUS BUILDING CLOSURE ITEMS SUCH AS DOORS AND WINDOWS (WHEN FURNISHED BY THE MANUFACTURER), CONNECTORS, COMPONENTS, AND FASTENERS, AND OTHER SYSTEM COMPONENTS AND ASSEMBLIES INSTALLED TO PROVIDE A WEATHERTIGHT SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THESE SPECIFICATIONS THAT BECOME PART OF THE METAL BUILDING SYSTEM. ALL MATERIAL AND WORKMANSHIP DEFICIENCIES, SYSTEM DETERIORATION CAUSED BY EXPOSURE TO THE ELEMENTS AND/OR INADEQUATE RESISTANCE TO SPECIFIED SERVICE DESIGN LOADS, WATER LEAKS AND WIND UPLIFT DAMAGE SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE AND LEAKAGE ASSOCIATED WITH THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON [_____] AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

(Company President)

(Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
METAL BUILDING SYSTEM
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE METAL BUILDING SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE BUILDING SYSTEM DUE TO ACTIONS BY THE OWNER WHICH INHIBIT FREE DRAINAGE FROM THE ROOF, GUTTERS AND DOWNSPOUTS; OR CONDITIONS WHICH CREATE PONDING WATER ON THE ROOF OR AGAINST THE BUILDING SIDING.
6. THIS WARRANTY APPLIES TO THE METAL BUILDING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES. REPORTS OF LEAKS AND BUILDING SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE BY TELEPHONE OR IN WRITING FROM EITHER THE OWNER, OR CONTRACTING OFFICER. EMERGENCY REPAIRS, TO PREVENT FURTHER ROOF LEAKS, SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
METAL BUILDING SYSTEM
(Exclusions from Coverage Continued)

IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE METAL BUILDING SYSTEM REPLACED OR REPAIRED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR. IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION, UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED THE PARTIES SHALL, WITHIN 10 DAYS JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN 10 DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

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SECTION 13798
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-- End of Section Table of Contents --

SECTION 13798

DURESS SIGNAL SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6 (2000; Bul. 2001, 2002) Rigid Metal Conduit

UL 50 (1995; R 1999, Bul. 2001) Safety Enclosures for Electrical Equipment

UL 797 (2000; Bul. 2002) Electrical Metallic Tubing

1.1.1 SYSTEM

The Contractor shall obtain the services of an alarm company to design, supervise, and configure the duress system as described.

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings G,_RE, DOIM

Overall duress signal system design

Duress equipment and components

Indicate how each item of equipment will function in the system and include an overall system schematic indicating the relationship of intercommunication units on one line diagram.

SD-03 Product Data

Duress equipment and components

Submit for materials and equipment to be incorporated in work.

SD-07 Certificates

Duress equipment and components

Submit manufacturer's certificates attesting that materials meet specified requirements.

SD-10 Operation and Maintenance Data

Duress signal system, Data Package

1.3 MAINTENANCE

Submit operation and maintenance data of entire duress signal system

PART 2 PRODUCTS

2.1 EQUIPMENT AND COMPONENTS

Equipment and components of the Duress Signal System shall conform to applicable requirements of Article 810, NFPA 70.

2.1.1 Signal Stations

Duress signal stations shall be momentary contact devices rated for operation on 24 V dc.

2.1.1.1 Wall Mounted Duress Stations

Low voltage, nonilluminated single pole, normally open, momentary contact pushbutton with silver contacts rated for two amperes at 24 V dc with 25,000 cycles minimum electrical/mechanical life. Bezel shall be black, full shroud type. Cap or button shall be blue. Device plate shall be nylon with ivory finish. Provide one duress station in each of the guard houses and gate house.

2.1.1.2 Control Panel

Provide a new control panel at the gate house for sending duress signal to the existing monitoring system in the MP Station. Control panel shall be compatible with the existing monitoring system in the MP Station. Flush mount pilot lamps silencing switch and audible signal alarm on panel door. Socket mount auxiliary relays within cabinet. Provide control power supply within cabinet. Wiring within cabinet shall be in accordance with Section 16415, "Electrical Work, Interior " and shall terminate on identified terminal blocks. Terminations shall be made with crimp type lugs. Group conductors within the panel and lace with nylon tie straps.

2.1.2.1 Duress System Indicators

24 V dc Light Emitting Diodes (LEDs) mounted in cover of duress system control panel. Provide a local weatherproof horn system under the canopy to indicate the duress system has activated. The horn system shall produce 101db at 10 feet under the canopy area.

2.1.2.2 Silencing Switch

Low voltage, square, nonilluminated single pole, normally open, momentary contact pushbutton located on the control panel to silence the horn and reset the duress signal.

2.1.2.3 Power Supply

Provide 24 V dc power supply to the duress signal system. Output shall be not less than one and one half times the sum of the load of all the relays on the watchtour system. Provide glass cartridge fuse rated at 125 percent of full load. Power supply shall be UL listed. Power supply shall be served from 120 V ac 60 Hz circuit from the Emergency Power System.

2.2 WIRE AND RACEWAYS

Conform to UL 6 and UL 797. Cabinets and boxes shall conform to UL 50.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Power Wiring

Provide power wiring, raceway and outlet boxes for intercommunication system in accordance with Section 16415, "Electrical Work, Interior ."

3.1.2 Control Circuit Wiring

Provide control circuits in accordance with NFPA 70. Wire and number of conductors as recommended by the duress system manufacturer.

3.1.3 Wiring

No. 16 AWG, stranded, Type MTW installed in concealed conduit. Connections to terminal blocks shall be made with crimp type lugs.

3.1.4 Back Boxes

Provide back boxes having characteristics suitable for switches mounted in them.

3.1.5 Repairs

Wherever walls, ceilings, or floors are cut for installation, repair, restore and finish to original appearance.

3.1.6 Signal Stations

The wall mounted duress station shall be mounted 54 inches above the finished floor with 1/4 inch - 20 - 1 inch long tamper proof screw. The system shall be completely checked out and tested before installation of the fasteners.

3.2 FIELD QUALITY CONTROL

Conduct testing specified herein in the presence of the Contracting Officer.

3.2.1 Duress System Test

An operational system test shall be performed to verify conformance of the duress system to this specification. The Contractor shall notify the Contracting Officer two weeks prior to when tests are to be performed so that tests may be witnessed by Contracting Officer. These tests shall include alarms from gate house and guard houses to MP Station.

3.2.2 Retesting

Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies.

3.2.3 Inspection

Make observations to verify that units and controls are properly labeled, and interconnecting wire and terminals identified. Contracting Officer will observe system features specified.

3.3 TRAINING OPERATING AND MAINTENANCE PERSONNEL

3.3.1 Instructing Government Personnel

Upon completion of the work and at a time designated by the Contracting Officer, furnish a competent technician regularly employed or authorized by the manufacturer of the duress system to instruct Government personnel in the proper operation, maintenance, safety, and emergency procedures of the duress system. The period of instruction shall be four eight-hour working days. Conduct training at the job site.

-- End of Section --

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 - 3.1.1.3 Protection of Fixtures, Materials, and Equipment
 - 3.1.1.4 Mains, Branches, and Runouts
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 - 3.1.2.6 Copper Tube and Pipe
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- 3.1.4 Corrosion Protection for Buried Pipe and Fittings
 - 3.1.4.1 Cast Iron and Ductile Iron
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- 3.1.5 Pipe Sleeves and Flashing
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 - 3.1.5.2 Flashing Requirements
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 - 3.1.5.4 Optional Counterflashing
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SECTION 15400A

PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

- | | |
|----------|---|
| ARI 1010 | (1994) Self-Contained, Mechanically Refrigerated Drinking-Water Coolers |
| ARI 700 | (1999) Specifications for Fluorocarbon and Other Refrigerants |

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|---------------|---|
| ANSI A117.1 | (1998) ICC/ANSI A117.1 (Guidelines for Access Usable Buildings and Facilities) |
| ANSI Z21.10.1 | (2001) Gas Water Heaters Vol. I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less |
| ANSI Z21.10.3 | (2001) Gas Water Heaters Vol.III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous Water Heaters |
| ANSI Z21.22 | (1999; 2001) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems |
| ANSI Z21.56 | (2001) Gas-Fired Pool Heaters |
| ANSI Z124.1 | (1995) Plastic Bathtub Units |
| ANSI Z124.3 | (1995) Plastic Lavatories |
| ANSI Z124.5 | (1997) Plastic Toilet (Water Closets) Seats |
| ANSI Z124.9 | (1994) Plastic Urinal Fixtures |
| ANSI Z358.1 | (1998) Emergency Eyewash and Shower Equipment |

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------------|--|
| ASTM A 105/A 105M | (2001) Carbon Steel Forgings for Piping Applications |
|-------------------|--|

ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(2001b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 515/A 515M	(2001) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516/A 516M	(2001) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 518/A 518M	(1999) Corrosion-Resistant High-Silicon Iron Castings
ASTM A 53/A 53M	(2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 733	(2001) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A 74	(1998) Cast Iron Soil Pipe and Fittings
ASTM A 888	(1998e1) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B 111	(1998e1) Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock
ASTM B 111M	(1998e1) Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock (Metric)
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM B 152/B 152M	(2000) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 306	(1999) Copper Drainage Tube (DWV)
ASTM B 32	(2000) Solder Metal
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM B 42	(1998) Seamless Copper Pipe, Standard Sizes
ASTM B 43	(1998) Seamless Red Brass Pipe, Standard Sizes
ASTM B 584	(2000) Copper Alloy Sand Castings for General Applications

ASTM B 75	(1999) Seamless Copper Tube
ASTM B 75M	(1999) Seamless Copper Tube (Metric)
ASTM B 813	(2000) Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B 828	(2000) Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B 88	(1999e1) Seamless Copper Water Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM C 1053	(2000) Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM C 564	(1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 1004	(1994a) Initial Tear Resistance of Plastic Film and Sheet
ASTM D 1248	(2000a) Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D 1785	(1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2000	(2001) Rubber Products in Automotive Applications
ASTM D 2235	(2001) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2239	(2001) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D 2241	(2000) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2447	(2001) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2001) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2001) Poly(Vinyl Chloride) (PVC) Plastic

Pipe Fittings, Schedule 80

ASTM D 2485	(1991; R 2000) Evaluating Coatings for High Temperature Service
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1997) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D 2661	(2001) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2665	(2000) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2672	(1996a) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D 2683	(1998) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D 2737	(2001) Polyethylene (PE) Plastic Tubing
ASTM D 2822	(1991; R 1997e1) Asphalt Roof Cement
ASTM D 2846/D 2846M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2996	(2001) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3035	(2001) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D 3122	(1995) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings
ASTM D 3138	(1995) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

ASTM D 3261	(1997) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3308	(2001) PTFE Resin Skived Tape
ASTM D 3311	(1994) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM D 4060	(2001) Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D 4101	(2002) Propylene Plastic Injection and Extrusion Materials
ASTM D 4551	(1996; R 2001) Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane
ASTM D 638	(2001) Tensile Properties of Plastics
ASTM D 638M	(1996) Tensile Properties of Plastics (Metric)
ASTM E 1	(2001) ASTM Thermometers
ASTM E 96	(2000e1) Water Vapor Transmission of Materials
ASTM F 1290	(1998a) Electrofusion Joining Polyolefin Pipe and Fittings
ASTM F 1760	(2001) Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F 409	(1999a) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 437	(1999) Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 438	(2001) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F 439	(2001) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 441/F 441M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F 442/F 442M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)

ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 493	(1997) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 628	(2001) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core
ASTM F 877	(2001e1) Crosslinked Polyethylene (PEX) Plastic Hot- and Cold- Water Distribution Systems
ASTM F 891	(2000) Coextruded Poly (Vinyl chloride) (PVC) Plastic Pipe with a Cellular Core

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 34	(2001; Errata 2002) Number Designation and Safety Classification of Refrigerants
ASHRAE 90.1	(2001; Errata 2002) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001	(2002) Pipe Applied Atmospheric Type Vacuum Breakers
ASSE 1002	(1999) Anti-siphon Fill Valves (Ballcocks) for Water Closet Flush Tanks
ASSE 1003	(2001) Water Pressure Reducing Valves
ASSE 1005	(1999) Water Heater Drain Valves
ASSE 1006	(1986) Residential Use Dishwashers
ASSE 1011	(1993) Hose Connection Vacuum Breakers
ASSE 1012	(1993) Backflow Preventers with Intermediate Atmospheric Vent
ASSE 1013	(1999) Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers
ASSE 1018	(2001) Trap Seal Primer Valves, Water Supply Fed
ASSE 1020	(1998) Pressure Vacuum Breaker Assembly
ASSE 1037	(1990; Rev thru Mar 1990) Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C105	(1999) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C203	(1997; C203a99) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA C700	(1995) Cold-Water Meters - Displacement Type, Bronze Main Case
AWWA C701	(1988) Cold-Water Meters - Turbine Type, for Customer Service
AWWA D100	(1996) Welded Steel Tanks for Water Storage
AWWA EWW	(1998) Standard Methods for the Examination of Water and Wastewater
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification

ASME INTERNATIONAL (ASME)

ASME A112.1.2	(1991; R 1998) Air Gaps in Plumbing Systems
ASME A112.14.1	(1975; R 1998) Backwater Valves
ASME A112.18.1M	(2000) Plumbing Fixture Fittings
ASME A112.19.1M	(1994; R 1999) Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	(1998) Vitreous China Plumbing Fixtures
ASME A112.19.3M	(2001) Stainless Steel Fixtures (Designed for Residential Use)
ASME A112.19.4M	(1994; R 1999) Porcelain Enameled Formed Steel Plumbing Fixtures
ASME A112.21.1M	(1991; R 1998) Floor Drains

ASME A112.21.2M	(1983) Roof Drains
ASME A112.36.2M	(1991; R 1998) Cleanouts
ASME A112.6.1M	(1997) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose, Inch
ASME B16.12	(1998) Cast Iron Threaded Drainage Fittings
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(2001) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(1992) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2002) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 400, 600, 900, 1500, and 2500
ASME B16.29	(2001) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.34	(1996) Valves Flanged, Threaded, and Welding End
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B31.1	(2001) Power Piping
ASME B31.5	(2001) Refrigeration Piping and Heat Transfer Components
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPVC SEC IX	(2001) Boiler and Pressure Vessel Code;

Section IX, Welding and Brazing
Qualifications

ASME CSD-1 (2002) Control and Safety Devices for
Automatically Fired Boilers

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301 (2000) Hubless Cast Iron Soil Pipe and
Fittings for Sanitary and Storm Drain,
Waste, and Vent Piping Applications

CISPI 310 (1997) Coupling for Use in Connection with
Hubless Cast Iron Soil Pipe and Fittings
for Sanitary and Storm Drain, Waste, and
Vent Piping Applications

CISPI HSN-85 (1985) Neoprene Rubber Gaskets for Hub and
Spigot Cast Iron Soil Pipe and Fittings

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015 (1994; R 1995) Copper Tube Handbook

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH
(FCCCHR)

FCCCHR Manual-9 (9th Edition) Manual of Cross-Connection
Control

HYDRAULIC INSTITUTE (HI)

HI 1.1-1.5 (1994) Centrifugal Nomenclature

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 (1998) Accessible and Usable Buildings and
Facilities

ICC International Plumbing Code (2000) International Plumbing Code

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-110 (1996) Ball Valves Threaded,
Socket-Welding, Solder Joint, Grooved and
Flared Ends

MSS SP-25 (1998) Standard Marking System for Valves,
Fittings, Flanges and Unions

MSS SP-44 (1996; R 2001) Steel Pipe Line Flanges

MSS SP-58 (1993) Pipe Hangers and Supports -
Materials, Design and Manufacture

MSS SP-67 (2002) Butterfly Valves

MSS SP-69 (1996) Pipe Hangers and Supports -

Selection and Application

MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-72	(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-73	(1991; R 1996) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-78	(1998) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(1995) Class 3000 Steel Pipe Unions Socket-Welding and Threaded
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(2001) Installation of Oil Burning Equipment
NFPA 54	(1999) National Fuel Gas Code
NFPA 90A	(1999) Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF 14	(2002) Plastics Piping Components and Related Materials
NSF 3	(2001) Commercial Warewashing Equipment
NSF 5	(2002e) Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment
NSF 61	(1999;2001 Addendum 1 - Sep 2001) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA-01	(1998) Plastic Pipe in Fire Resistive Construction
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PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI G 101 (1996) Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data

PDI WH 201 (1992) Water Hammer Arresters

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508 (1997) Hose Clamp Specifications

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 5 (2000) White Metal Blast Cleaning

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-240 (Rev A; Canc. Notice 1) Shower Head, Ball Joint

CID A-A-50012 (Basic) Garbage Disposal Machine, Commercial

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 430 Energy Conservation Program for Consumer Products

21 CFR 175 Indirect Food Additives: Adhesives and Components of Coatings

40 CFR 50.12 National Primary and Secondary Ambient Air Quality Standards for Lead

PL 93-523 (1974; A 1999) Safe Drinking Water Act

UNDERWRITERS LABORATORIES (UL)

UL 174 (1996; Rev thru Oct 1999) Household Electric Storage Tank Water Heaters

UL 430 (1994; Rev thru Mar 2001) Waste Disposers

UL 732 (1995; Rev thru Jan 1999) Oil-Fired Storage Tank Water Heaters

UL 749 (1997; Rev thru Feb 1999) Household Dishwashers

UL 921 (1996; Rev thru Mar 2000) Commercial Electric Dishwashers

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the

Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System; .

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operations of each system. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

Electrical Work; .

Complete electrical schematic lineless or full line interconnection and connection diagram for each piece of mechanical equipment having more than one automatic or manual electrical control device.

SD-03 Product Data

Welding; .

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

Plumbing Fixture Schedule; .

Catalog cuts of specified plumbing fixtures system and system location where installed.

Details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications.

Plumbing System; .

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

SD-06 Test Reports

Tests, Flushing and Disinfection; .

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-07 Certificates

Materials and Equipment; .

Where materials or equipment are specified to comply with requirements of AGA, ASME, or NSF proof of such compliance shall be included. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

Bolts; .

Written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

SD-10 Operation and Maintenance Data

Plumbing System; .

Six copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening.

1.4 ELECTRICAL WORK

Motors, motor controllers and motor efficiencies shall conform to the requirements of Section 16415A ELECTRICAL WORK, INTERIOR. Electrical motor-driven equipment specified herein shall be provided complete with motors. Equipment shall be rated at 60 Hz, single phase, ac unless otherwise indicated. Where a motor controller is not provided in a motor-control center on the electrical drawings, a motor controller shall be as indicated. Motor controllers shall be provided complete with properly sized thermal-overload protection in each ungrounded conductor, auxiliary contact, and other equipment, at the specified capacity, and

including an allowable service factor.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.

1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC International Plumbing Code.

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II.

Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF 61, Section 8.

End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF 61, Section 9. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used under ground. Joints and gasket materials shall conform to the following:

- a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A 74,

- AWWA C606. For hubless type: CISPI 310
- b. Coupling for Steel Pipe: AWWA C606.
 - c. Couplings for Grooved Pipe: . Copper ASTM A 536.
 - d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
 - e. Neoprene Gaskets for Hub and Cast-Iron Pipe and Fittings: CISPI HSN-85.
 - f. Brazing Material: Brazing material shall conform to AWS A5.8, BCuP-5.
 - g. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.
 - h. Solder Material: Solder metal shall conform to ASTM B 32.
 - i. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.
 - j. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe, ASTM D 3308.
 - k. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C 564.
 - l. Rubber Gaskets for Grooved Pipe: ASTM D 2000, maximum temperature 230 degrees F.
 - m. Flexible Elastomeric Seals: ASTM D 3139, ASTM D 3212 or ASTM F 477.
 - n. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A 183.
 - o. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D 3138.
 - p. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D 2235.
 - q. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.
 - r. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.
 - s. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high

strength or intermediate strength with material conforming to ASTM A 193/A 193M.

- t. Plastic Solvent Cement for Styrene Rubber Plastic Pipe: ASTM D 3122.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

- a. Water Hammer Arrestor: PDI WH 201.
- b. Copper, Sheet and Strip for Building Construction: ASTM B 370.
- c. Asphalt Roof Cement: ASTM D 2822.
- d. Hose Clamps: SAE J1508.
- e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.
- f. Metallic Cleanouts: ASME A112.36.2M.
- g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.
- h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.
- i. Hypochlorites: AWWA B300.
- j. Liquid Chlorine: AWWA B301.
- k. Polyethylene Encasement for Ductile-Iron Piping: AWWA C105.
- l. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.1.
- m. Thermometers: ASTM E 1. Mercury shall not be used in thermometers.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer

certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

2.3.1 Wall Faucets

Wall faucets (HOSE BIBB) with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

2.3.2 Wall Hydrants

Wall hydrants with vacuum-breaker backflow preventer shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through the

wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 3/4 inch exposed hose thread on spout and 3/4 inch male pipe thread on inlet.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with ICC International Plumbing Code. . Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap.

Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature. Plumbing fixtures shall be as indicated in paragraph PLUMBING FIXTURE SCHEDULE.

2.4.1 Lavatories

Enameled cast-iron lavatories shall be provided with two cast-iron or steel brackets secured to the underside of the apron and drilled for bolting to the wall in a manner similar to the hanger plate. Exposed brackets shall be porcelain enameled.

2.5 BACKFLOW PREVENTERS

Backflow preventers shall be approved and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCCHR Manual-9. Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Pressure vacuum breaker assembly shall conform to ASSE 1020. Air gaps in plumbing systems shall conform to ASME A112.1.2.

2.6 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409 or copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the

outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Plastic pipe shall not be installed in air plenums. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA-01. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A gate valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 3/4 inch hose bibb with renewable seat and ball valve ahead of hose bibb. At other low points, 3/4 inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.1.1.7 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 4 inches in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.1.8 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to PDI WH 201. Vertical capped pipe columns will not be permitted.

3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.2.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.2.2 Mechanical Couplings

Grooved mechanical joints shall be prepared according to the coupling manufacturer's instructions. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, or narrow-land micrometer. Groove width and dimension of groove from end of the pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.1.2.3 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches

and smaller; flanges shall be used on pipe sizes 3 inches and larger.

3.1.2.4 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

3.1.2.5 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.2.6 Copper Tube and Pipe

The tube or fittings shall not be annealed when making connections.

- a. Brazed. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.
- b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.
- c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC International Plumbing Code.

3.1.2.7 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.3 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric

waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.4 Corrosion Protection for Buried Pipe and Fittings

3.1.4.1 Cast Iron and Ductile Iron

Pressure pipe shall have protective coating, a cathodic protection system, and joint bonding. Pipe, fittings, and joints shall have a protective coating. The protective coating shall be completely encasing polyethylene tube or sheet in accordance with AWWA C105. Joints and fittings shall be cleaned, coated with primer, and wrapped with tape. The pipe shall be cleaned, coated, and wrapped prior to pipe tightness testing. Joints and fittings shall be cleaned, coated, and wrapped after pipe tightness testing. Tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer shall be as recommended by the tape manufacturer.

3.1.4.2 Steel

Steel pipe, joints, and fittings shall be cleaned, coated with primer, and wrapped with tape. Pipe shall be cleaned, coated, and wrapped prior to pipe tightness testing. Joints and fittings shall be cleaned, coated, and wrapped after pipe tightness testing. Tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer shall be as recommended by the tape manufacturer.

3.1.5 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.5.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for supply, drainage, waste and vent pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor. Unless otherwise indicated, sleeves shall

be of a size to provide a minimum of 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C 920 and with a primer, backstop material and surface preparation as specified in Section 07900A JOINT SEALING. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and masonry wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07840A FIRESTOPPING.

3.1.5.2 Flashing Requirements

Pipes passing through roof shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.5.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside

diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.5.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

- a. A standard roof coupling for threaded pipe up to 6 inches in diameter.
- b. A tack-welded or banded-metal rain shield around the pipe.

3.1.5.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07900A JOINT SEALING.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 6 inches above the top of the tank or water heater.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided.

Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 31 inches above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 42 inches above floor. Wall-hung service sinks shall be mounted with rim 28 inches above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with ICC A117.1.

3.4 TESTS, FLUSHING AND DISINFECTION

3.4.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with ICC International Plumbing Code, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure to the Contracting Officer for approval.

- a. Drainage and Vent Systems Test. The final test shall include a smoke test.
- b. Building Sewers Tests.
- c. Water Supply Systems Tests.

3.4.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.4.3 System Flushing

3.4.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration.

3.4.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation.

3.4.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

- a. Time, date, and duration of test.
- b. Water pressures at the most remote and the highest fixtures.
- c. Operation of each fixture and fixture trim.
- d. Operation of each valve, hydrant, and faucet.
- f. Temperature of each domestic hot-water supply.
- i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.

3.4.5 Disinfection

After operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. System shall be flushed as specified, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being disinfected shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall

remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6 hour period, no less than 50 ppm chlorine residual shall remain in the tank. If after the 24 hour and 6 hour holding periods, the residual solution contains less than 25 ppm and 50 ppm chlorine respectively, flush the piping and tank with potable water, and repeat the above procedures until the required residual chlorine levels are satisfied. The system including the tanks shall then be flushed with clean water until the residual chlorine level is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. Samples of water in disinfected containers shall be obtained from several locations selected by the Contracting Officer. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. Disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.5 PLUMBING FIXTURE SCHEDULE

P-1 WATER CLOSET:

Siphon-jet, elongated bowl, top supply spud, ASME A112.19.2M, floor mounted. Floor flange shall be copper alloy, cast iron, or plastic.

Gasket shall be wax type.

Seat - ANSI Z124.5, Type A, white plastic, elongated, open front.

Flush Tank - An adequate quantity of water shall be provided to flush and clean the fixture served. The water supply to flush tanks equipped for manual flushing shall be controlled by a float valve or other automatic device designed to refill the tank after each discharge, and to completely shut off the water flow to the tank when the tank is filled to operational capacity. Water closets having their flush valve seat located below the flood level rim of the closet bowl shall have a ballcock installed within a sheath or in a separate and isolated compartment of the tank, both to have visible discharge onto the floor in case of failure. Provision shall be made to automatically supply water to the fixture so as to refill the trap seal after each flushing. The water supply to flush tanks equipped for automatic flushing shall be controlled by a suitable timing device. Ballcocks shall meet ASSE 1002.

Flush Valve in Flush Tank - Flush valve seats in tanks for flushing water closets shall be at least 1 inch above the flood level rim of the bowl connected thereto, except in approved water closet and flush tank combinations designed so that when the tank is flushed and the fixture is clogged or partially clogged, the flush valve shall close tightly so that water will not spill continuously over the rim of the bowl or back flow from the bowl to the tank.

P-2 LAVATORY:

Manufacturer's standard sink depth, enameled cast iron ASME A112.19.1M

ledge back.

Faucet - Faucets shall meet the requirements of NSF 61, Section 9. Faucets shall be single center set type. Faucets shall have replaceable seats and washers. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. Flow shall be limited to 0.25 gallon per cycle at a flowing water pressure of 80 psi if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 2.5 gpm at a flowing pressure of 80 psi.

Handles - Index turn type. Cast, formed, or drop forged copper alloy.

Drain - Pop-up drain shall include stopper, lift rods, jam nut, washer, and tail piece. See paragraph FIXTURES for optional plastic accessories.

3.6 TABLES

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE					
		A	B	C	D	E	F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets	X	X	X	X	X	
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A 888		X	X	X	X	
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X		X	X		
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X	X	
5	Grooved pipe couplings, ferrous and non-ferrous pipe ASTM A 536 and ASTM A 47/A 47M	X	X		X	X	
6	Ductile iron grooved joint fittings for ferrous pipe ASTM A 536 and ASTM A 47/A 47M for use with Item 5	X	X		X	X	
7	Bronze sand casting grooved joint pressure fittings for non-ferrous pipe ASTM B 584, for use with Item 5	X	X		X	X	
8	Wrought copper grooved joint pressure fittings for non-ferrous pipe ASTM B 75 C12200, ASTM B 152/B 152M, C11000, ASME B16.22 ASME B16.22 for use with Item 5	X	X				
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X	X	
10	Steel pipe, seamless galvanized, ASTM A 53/A 53M, Type S, Grade B	X			X	X	
11	Seamless red brass pipe, ASTM B 43		X	X			
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X	

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE					
Item #	Pipe and Fitting Materials	A	B	C	D	E	F
13	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 14				X	X	
14	Seamless copper pipe, ASTM B 42				X		
15	Cast bronze threaded fittings, ASME B16.15				X	X	
16	Copper drainage tube, (DWV), ASTM B 306	X*	X	X*	X	X	
17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X	
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X	
19	Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe and fittings ASTM D 2661, ASTM F 628	X	X	X	X	X	X
20	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D 2665, ASTM F 891, (Sch 40) ASTM F 1760	X	X	X	X	X	X
21	Process glass pipe and fittings, ASTM C 1053						X
22	High-silicon content cast iron pipe and fittings (hub and spigot, and mechanical joint), ASTM A 518/A 518M		X			X	X
23	Polypropylene (PP) waste pipe and fittings, ASTM D 4101						X
24	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D 2996						X

SERVICE:

A - Underground Building Soil, Waste and Storm Drain
B - Aboveground Soil, Waste, Drain In Buildings
C - Underground Vent

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE					
Item #	Pipe and Fitting Materials	A	B	C	D	E	F
	D - Aboveground Vent						
	E - Interior Rainwater Conductors Aboveground						
	F - Corrosive Waste And Vent Above And Belowground						
	* - Hard Temper						

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe and Fitting Materials	SERVICE			
		A	B	C	D
1	Malleable-iron threaded fittings, a. Galvanized, ASME B16.3 for use with Item 4a	X	X	X	X
	b. Same as "a" but not galvanized for use with Item 4b			X	
2	Grooved pipe couplings, ferrous pipe ASTM A 536 and ASTM A 47/A 47M, non-ferrous pipe, ASTM A 536 and ASTM A 47/A 47M,	X	X	X	
3	Ductile iron grooved joint fittings for ferrous pipe ASTM A 536 and ASTM A 47/A 47M, for use with Item 2	X	X	X	
4	Steel pipe: a. Seamless, galvanized, ASTM A 53/A 53M, Type S, Grade B	X	X	X	X
	b. Seamless, black, ASTM A 53/A 53M, Type S, Grade B			X	
5	Seamless red brass pipe, ASTM B 43	X	X		X
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7	X	X		X
7	Seamless copper pipe, ASTM B 42	X	X		X
8	Seamless copper water tube, ASTM B 88, ASTM B 88M	X**	X**	X**	X***
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5 and 7	X	X	X	X
11	Cast copper alloy solder-joint pressure fittings,	X	X	X	X

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe and Fitting Materials	SERVICE			
		A	B	C	D
	ASME B16.18 for use with Items 8 and 9				
12	Bronze and sand castings grooved joint pressure fittings for non-ferrous pipe ASTM B 584, for use with Item 2	X	X	X	
13	Polyethylene (PE) plastic pipe, Schedules 40 and 80, based on outside diameter ASTM D 2447	X			X
14	Polyethylene (PE) plastic pipe (SDR-PR), based on controlled outside diameter, ASTM D 3035	X			X
15	Polyethylene (PE) plastic pipe (SIDR-PR), based on controlled inside diameter, ASTM D 2239	X			X
16	Butt fusion polyethylene (PE) plastic pipe fittings, ASTM D 3261 for use with Items 14, 15, and 16	X			X
17	Socket-type polyethylene fittings for outside diameter-controlled polyethylene pipe, ASTM D 2683 for use with Item 15	X			X
18	Polyethylene (PE) plastic tubing, ASTM D 2737	X			X
19	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D 2846/D 2846M	X	X		X
20	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F 441/F 441M	X	X		X
21	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F 442/F 442M	X	X		X
22	Threaded chlorinated polyvinyl chloride (chloride CPVC) plastic pipe fittings,	X	X		X

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe and Fitting Materials	SERVICE			
		A	B	C	D
	Schedule 80, ASTM F 437, for use with Items 20, and 21				
23	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F 438 for use with Items 20, 21, and 22	X	X		X
24	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F 439 for use with Items 20, 21, and 22	X	X		X
25	Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D 1785	X			X
26	Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D 2241	X			X
27	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D 2466	X			X
28	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D 2467 for use with Items 26 and 27	X			X
29	Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D 2464	X			X
30	Joints for IPS pvs pipe using solvent cement, ASTM D 2672	X			X
31	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D 2996	X	X		
32	Steel pipeline flanges, MSS SP-44	X	X		
33	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B 828	X	X		
34	Carbon steel pipe unions,	X	X	X	

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

		SERVICE			
Item No.	Pipe and Fitting Materials	A	B	C	D
	socket-welding and threaded, MSS SP-83				
35	Malleable-iron threaded pipe unions ASME B16.39	X	X		
36	Nipples, pipe threaded ASTM A 733	X	X	X	
37	Crosslinked Polyethylene (PEX) Plastic Pipe ASTM F 877.	X			X

A - Cold Water Aboveground

B - Hot Water 180 degrees F Maximum Aboveground

C - Compressed Air Lubricated

D - Cold Water Service Belowground

Indicated types are minimum wall thicknesses.

** - Type L - Hard

*** - Type K - Hard temper with brazed joints only or type K-soft temper
without joints in or under floors

**** - In or under slab floors only brazed joints

TABLE III
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING
EQUIPMENT

A. STORAGE WATER HEATERS

FUEL	STORAGE CAPACITY GALLONS		INPUT RATING	TEST PROCEDURE	REQUIRED
Elect.	120 max.		12 kW max.	10 CFR 430	EF = 0.95-0.00132V minimum
Elect.	120 min.	OR	12 kW min.	ASHRAE 90.1 (Addenda B)	SL = 1.9 W/sq. ft. maximum
Gas	100 max.		75,000 Btu/h max.	10 CFR 430	EF = 0.62-0.0019V minimum
Gas	100 min.	OR	75,000 Btu/h	ANSI Z21.10.3	ET = 77 percent; SL = 1.3+38/V max.
Oil	50 max.		105,000 Btu/h	10 CFR 430	EF = 0.59-0.0019V minimum
Oil	51 min.	OR	105,000 Btu/h	10 CFR 430	EC = 83 percent; SL = 1.3+38/V maximum

B. Unfired Hot Water Storage, instantaneous water heater, and pool heater.

Volumes and inputs: maximum HL shall be 6.5 Btu/h/sq. ft.

C. Instantaneous Water Heater

Gas	All		All	ANSI Z21.10.3	ET = 80 percent
Oil	All		All	ANSI Z21.10.3	EC = 83 percent

D. Pool Heater

Gas or Oil	All		All	ANSI Z21.56	ET = 78 percent
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TERMS:

EF = Energy factor, overall efficiency.

ET = Thermal efficiency with 70 degrees F delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = 0
(trace is permitted).

SL = Standby loss in W/sq. ft. based on 80 degrees F delta T, or in
percent per hour based on nominal 90 degrees F delta T.

HL = Heat loss of tank surface area

V = Storage volume in gallons

-- End of Section --

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SECTION 15700A

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SECTION 15700A

UNITARY HEATING AND COOLING EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 210/240	(1994) Unitary Air-Conditioning and Air-Source Heat Pump Equipment
ARI 270	(1995) Sound Rating of Outdoor Unitary Equipment
ARI 310/380	(1993) Packaged Terminal Air-Conditioners and Heat Pumps
ARI 320	(1998)) Water-Source Heat Pumps
ARI 325	(1998) Ground Water-Source Heat Pumps
ARI 340/360	(1993) Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
ARI 350	(1986) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
ARI 370	(1986) Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment
ARI 410	(1991) Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 460	(2000) Remote Mechanical-Draft Air-Cooled Refrigerant Condensers
ARI 490	(1998) Remote Mechanical-Draft Evaporative Refrigerant Condensers
ARI 495	(1999) Refrigerant Liquid Receivers
ARI 500	(2000) Variable Capacity Positive Displacement Refrigerant Compressors and Compressor Units for Air-Conditioning and Heat Pump Applications
ARI 700	(1999) Specifications for Fluorocarbon and Other Refrigerants

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(2001) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2001) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(2000) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM C 1071	(1998) Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)
ASTM D 520	(2000) Zinc Dust Pigment
ASTM E 437	(1992; R 1997) Industrial Wire Cloth and Screens (Square Opening Series)
ASTM E 84	(2000a) Surface Burning Characteristics of Building Materials
ASTM F 104	(1995) Nonmetallic Gasket Materials
ASTM F 872	(1984; R 1990) Filter Units, Air Conditioning: Viscous-Impingement Type, Cleanable

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 127	(1988) Method of Testing for Rating Computer and Data Processing Room Unitary Air-Conditioners
ASHRAE 15	(1994) Safety Code for Mechanical Refrigeration
ASHRAE 34	(1997) Number Designation and Safety Classification of Refrigerants
ASHRAE 52.1	(1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
ASHRAE 64	(1995) Methods of Testing Remote Mechanical-Draft Evaporative Refrigerant Condensers

AMERICAN WELDING SOCIETY (AWS)

AWS Z49.1	(1999) Safety in Welding and Cutting
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ASME INTERNATIONAL (ASME)

ASME BPVC SEC IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME BPVC SEC VIII D1	(1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASSOCIATION OF HOME APPLIANCE MANUFACTURERS (AHAM)

AHAM RAC-1	(1997) Directory of Certified Room Air Conditioners
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6	(1993) Industrial Control and Systems, Enclosures
NEMA MG 1	(1998) Motors and Generators
NEMA MG 2	(1989) Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(1999) National Fuel Gas Code
NFPA 70	(1999) National Electrical Code
NFPA 90A	(1999) Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 1995	(1995; Rev thru Aug 1999) Heating and Cooling Equipment
UL 207	(1993; Rev thru Oct 1997) Refrigerant-Containing Components and Accessories, Nonelectrical
UL 484	(1993; Rev thru Feb 1999) Room Air Conditioners
UL 586	(1996; Rev thru Aug 1999) High-Efficiency, Particulate, Air Filter Units
UL 900	(1994; Rev thru Nov 1999) Test Performance of Air Filter Units

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G, PO

Drawings provided in adequate detail to demonstrate compliance with contract requirements. Drawings shall consist of:

- a. Equipment layouts which identify assembly and installation details.
- b. Plans and elevations which identify clearances required for maintenance and operation.
- c. Wiring diagrams which identify each component individually and interconnected or interlocked relationships between components.
- d. Foundation drawings, bolt-setting information, and foundation bolts prior to concrete foundation construction for equipment indicated or required to have concrete foundations.
- e. Details, if piping and equipment are to be supported other than as indicated, which include loadings and type of frames, brackets, stanchions, or other supports.
- f. Automatic temperature control diagrams and control sequences.
- g. Installation details which includes the amount of factory set superheat and corresponding refrigerant pressure/temperature.

SD-03 Product Data

Unitary Equipment; G, PO

Manufacturer's standard catalog data, at least 5 weeks prior to the purchase or installation of a particular component, highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Data shall include manufacturer's recommended installation instructions and procedures. If vibration isolation is specified for a unit, vibration isolator literature shall be included containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations. Data shall be submitted for each specified component.

Spare Parts Data; G, PO

Spare parts data for each different item of equipment specified, after approval of detail drawings and not later than 1 month prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

Posted Instructions;

Posted instructions, at least 2 weeks prior to construction completion, including equipment layout, wiring and control

diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions shall be framed under glass or laminated plastic and be posted where indicated by the Contracting Officer.

Verification of Dimensions;

A letter, at least 2 weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found.

System Performance Tests; G, PO

A schedule, at least 2 weeks prior to the start of related testing, for the system performance tests. The schedules shall identify the proposed date, time, and location for each test.

Demonstrations;G, PO

A schedule, at least 2 weeks prior to the date of the proposed training course, which identifies the date, time, and location for the training.

SD-06 Test Reports

Refrigerant Tests, Charging, and Start-Up; G, PO

Six copies of each test containing the information described below in bound 8-1/2 x 11 inch booklets. Individual reports shall be submitted for the refrigerant system tests.

- a. The date the tests were performed.
- b. A list of equipment used, with calibration certifications.
- c. Initial test summaries.
- d. Repairs/adjustments performed.
- e. Final test results.

System Performance Tests; G, PO

Six copies of the report provided in bound 8-1/2 x 11 inch booklets. The report shall document compliance with the specified performance criteria upon completion and testing of the system. The report shall indicate the number of days covered by the tests and any conclusions as to the adequacy of the system. The report shall also include the following information and shall be taken at least three different times at outside dry-bulb temperatures that are at least 5 degrees F apart:

- a. Date and outside weather conditions.
- b. The load on the system based on the following:

- (1) The refrigerant used in the system.
- (2) Condensing temperature and pressure.
- (3) Suction temperature and pressure.
- (4) Ambient, condensing and coolant temperatures.
- (5) Running current, voltage and proper phase sequence for each phase of all motors.

c. The actual on-site setting of operating and safety controls.

h. Defrost system timer and thermostat set-points.

j. Capacity control set-points.

k. Field data and adjustments which affect unit performance and energy consumption.

l. Field adjustments and settings which were not permanently marked as an integral part of a device.

SD-07 Certificates

Unitary Equipment; G, PO

Where the system, components, or equipment are specified to comply with requirements of ARI, ASHRAE, ASME, or UL, proof of such compliance shall be provided. The label or listing of the specified agency shall be acceptable evidence. In lieu of the label or listing, a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency may be submitted. When performance requirements of this project's drawings and specifications vary from standard ARI rating conditions, computer printouts, catalog, or other application data certified by ARI or a nationally recognized laboratory as described above shall be included. If ARI does not have a current certification program that encompasses such application data, the manufacturer may self certify that his application data complies with project performance requirements in accordance with the specified test standards.

Service Organization; ,

A certified list of qualified permanent service organizations, which includes their addresses and qualifications, for support of the equipment. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

SD-10 Operation and Maintenance Data

Operation Manuals; G, PO

Six complete copies of an operation manual in bound 8 1/2 x 11 inch booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least 4 weeks prior to the first training course. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

Maintenance Manuals; G, PO

Six complete copies of maintenance manual in bound 8-1/2 x 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping and equipment layouts and simplified wiring and control diagrams of the system as installed.

1.3 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired. Welding and cutting safety requirements shall be in accordance with AWS Z49.1.

1.4 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.5 PROJECT/SITE CONDITIONS

1.5.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.5.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2 year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a 2 year field service record shall be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. Products shall be supported by a service organization. System components shall be environmentally suitable for the indicated locations.

2.2 NAMEPLATES

Major equipment including compressors, condensers, receivers, heat exchanges, fans, and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. Plates shall be durable and legible throughout equipment life and made of anodized aluminum or stainless steel. Plates shall be fixed in prominent locations with nonferrous screws or bolts.

2.3 ELECTRICAL WORK

Electrical equipment, motors, motor efficiencies, and wiring shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electrical characteristics shall be as shown, and unless otherwise indicated, all motors of 1 horsepower and above with open, dripproof, totally enclosed, or explosion proof fan cooled enclosures, shall be high efficiency type. Field wiring shall be in accordance with manufacturer's instructions. Each motor shall conform to NEMA MG 1 and NEMA MG 2 and be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Motors shall be continuous duty with the enclosure specified. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control indicated. Motors shall be furnished with a magnetic across-the-line or reduced voltage type starter as required by the manufacturer. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motors shall be sized for the applicable loads. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of enclosure. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided.

2.4 UNITARY EQUIPMENT, ROOM UNIT

2.4.1 Window or Through-the-Wall Mounted Unit

Unit shall be a through-the-wall mounted, appliance grade, factory

assembled air-conditioner unit. Unit shall be in accordance with AHAM RAC-1 and UL 484. Units shall include a self-contained, precharged, slide-in and removable chassis-mounted, air-cooled refrigeration system. Cooling section shall be equipped with a filter-drier on the suction line. Fan and condenser motors shall have dripproof enclosures.

2.4.2 Packaged Terminal Unit

Unit shall be a through-the-wall mounted, heavy-duty commercial grade, factory assembled and precharged heat pump unit. Unit shall be in accordance with ARI 310/380 and UL 1995. Units shall be removable from inside the building for servicing without removing the outside cabinet. Unit shall have a noise rating in accordance with ARI 350. Heat pump units shall contain a reversing valve to change unit to heating cycle. An outdoor coil temperature sensor shall be provided to guard against coil freeze-up by cycling the compressor to defrost the coil.

2.4.3 Compressor

Compressor shall be hermetically sealed reciprocating type. Compressor shall be fitted with permanent split capacitor motor, overload protection, and vibration isolators. Compressor shall be protected against high discharge pressure, loss of charge, low voltage, and short cycling.

2.4.4 Air-To-Refrigerant Coils

Evaporator and condenser coils shall have nonferrous tubes of 3/8 inch minimum diameter with aluminum fins that are mechanically bonded or soldered to the tubes. Casing shall be galvanized steel or aluminum. Contact of dissimilar metals shall be avoided. Coils shall be tested in accordance with ASHRAE 15 at the factory and be suitable for the working pressure of the installed system. Each coil shall be dehydrated and sealed after testing and prior to evaluation and charging. Each unit shall be provided with a factory operating charge of refrigerant and oil or a holding charge. Unit shipped with a holding charge shall be field charged. A condensate removal system shall be provided.

2.4.5 Fans

Indoor and outdoor fans shall be the centrifugal, direct driven type. Fans shall be statically and dynamically balanced. Outdoor fan shall be designed so that condensate will evaporate without drip, splash, or spray on building exterior. Indoor fan shall be provided with a minimum two-speed motor with built-in overload protection. Fan motors shall be the inherently protected, permanent split-capacitor type.

2.4.6 Air Filters

Filters shall be of the sectional or panel cleanable type and be capable of filtering the entire air supply.

2.4.7 Wall Sleeve

Louver shall be stormproof type, constructed of anodized, stamped or extruded aluminum. Sleeve shall be a water and airtight assembly, with weather-resistant protective coating.

2.4.8 Duct Package

Duct extension shall consist of 18 gauge minimum galvanized steel plenum extender with all necessary internal dampers and baffles to divert percent of the supply air as indicated. Duct extension shall be painted with a protective coating that matches room cabinet.

2.4.9 Unit Controls

Controls shall include an on-off switch, high and low selector switch for both the heating and cooling mode, multiple speed fan cooling and heating mode, room air fan switch, outside air damper control, and an adjustable cooling and heating thermostat. Function and temperature controls shall be integral to unit and remotely mounted as indicated or as accepted by the Contracting Officer.

2.5 UNITARY EQUIPMENT, PACKAGE SYSTEM

Unit shall be an air-cooled factory assembled, weatherproof packaged unit with cooling and heating capacity as indicated. Unit shall be the heat pump type conforming to applicable Underwriters Laboratories (UL) standards including UL 1995. Unit shall be rated in accordance with ARI 210/240. Unit shall be provided with equipment as specified in paragraph "Unitary Equipment Components". Evaporator or supply fans shall be double-width, double inlet, forward curved, backward inclined, or airfoil blade, centrifugal scroll type. Motors shall have totally enclosed enclosures. Condenser fans shall be manufacturer's standard for the unit specified and may be either propeller or centrifugal scroll type. Unit shall be provided with a factory operating charge of refrigerant and oil or a holding charge.

Unit shipped with a holding charge shall be field charged with refrigerant and oil in accordance with manufacturer's recommendations. Outdoor unit shall produce a maximum ARI sound rating of 8.4 bels in accordance with ARI 270.

2.5.1 Unit Controls

Unit shall be internally prewired with a 24 volt control circuit powered by an internal transformer.

PART 3 EXECUTION

3.1 SYSTEM PERFORMANCE TESTS

Before each refrigeration system is accepted, tests to demonstrate the general operating characteristics of all equipment shall be conducted by a registered professional engineer or an approved manufacturer's start-up representative experienced in system start-up and testing, at such times as directed. Tests shall cover a period of not less than 8 hours for each system and shall demonstrate that the entire system is functioning in accordance with the drawings and specifications. Corrections and adjustments shall be made as necessary and tests shall be re-conducted to demonstrate that the entire system is functioning as specified. Prior to acceptance, service valve seal caps and blanks over gauge points shall be installed and tightened. Any refrigerant lost during the system startup shall be replaced. If tests do not demonstrate satisfactory system performance, deficiencies shall be corrected and the system shall be retested. Tests shall be conducted in the presence of the Contracting Officer. Water and electricity required for the tests will be furnished by the Government. Any material, equipment, instruments, and personnel

required for the test shall be provided by the Contractor.

-- End of Section --

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SECTION 16070A

SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

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SECTION 16070A

SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 580	(1996) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint
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U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04	(1998) Seismic Design for Buildings
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UNDERWRITERS LABORATORIES (UL)

UL 1570	(1995; Rev thru Feb 1999) Fluorescent Lighting Fixtures
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UL 1571	(1995; Rev thru Feb 1999) Incandescent Lighting Fixtures
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Lighting Fixtures;
Equipment Requirements;

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-03 Product Data

Lighting Fixtures; G, RE
Equipment Requirements; G, RE

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

Contractor Designed Bracing; G, RE

Copies of the Design Calculations with the Drawings. Calculations shall be approved, certified, stamped and signed by a Registered Professional Engineer. Calculations shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

1.3 SYSTEM DESCRIPTION

1.3.1 General Requirements

The requirements for seismic protection measures described in this section shall be applied to the electrical equipment and systems listed below.

1.3.2 Electrical Equipment

Electrical equipment shall include the following items to the extent required in other sections of these specifications:

Panels	Generator
Motors	

1.3.3 Contractor Designed Bracing

The Contractor shall design the bracing in accordance with TI 809-04 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads. TI 809-04 uses parameters for the building, not for the equipment in the building; therefore, corresponding adjustments to the formulas shall be required. Loadings determined using TI 809-04 are based on strength design; therefore, the AISC LRFP specifications shall be used for the design.

1.3.4 Conduits Requiring No Special Seismic Restraints

Seismic restraints may be omitted from electrical conduit less than 2-1/2 inches trade size. All other interior conduit, shall be seismically protected as specified.

1.4 EQUIPMENT REQUIREMENTS

1.4.1 Rigidly Mounted Equipment

The following specific items of equipment: to be furnished under this contract shall be constructed and assembled to withstand the seismic forces specified in TI 809-04, Chapter 10. Each item of rigid electrical equipment shall be entirely located and rigidly attached on one side only of a building expansion joint. Piping, electrical conduit, etc., which cross the expansion joint shall be provided with flexible joints that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions.

Engine-Generators

Electronic Information Sign

PART 2 PRODUCTS

2.1 LIGHTING FIXTURE SUPPORTS

Lighting fixtures and supports shall conform to UL 1570 or UL 1571 as applicable.

PART 3 EXECUTION

3.1 LIGHTING FIXTURES

Lighting fixtures and supports shall conform to the following:

3.1.1 Exterior Fixtures

Exterior fixtures shall conform to the requirements of TI 809-04, Chapter 10.

3.1.2 Assembly Mounted on Outlet Box

A supporting assembly, that is intended to be mounted on an outlet box, shall be designed to accommodate mounting features on 4 inch boxes, plaster rings, and fixture studs.

3.1.3 Wall-Mounted Signal Light Unit

Attachments for wall-mounted signal light units shall be designed and secured for the worst expected seismic disturbance at the site.

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SECTION 16264A

LPG-GENERATOR SET, STATIONARY 15-300 KW, STANDBY APPLICATIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|-------------|--|
| ANSI C12.11 | (1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV) |
| ANSI C39.1 | (1981; R 1992) Requirements for Electrical Analog Indicating Instruments |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------------|--|
| ASTM A 53/A 53M | (1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| ASTM A 106 | (1999e1) Seamless Carbon Steel Pipe for High-Temperature Service |
| ASTM A 135 | (1997c) Electric-Resistance-Welded Steel Pipe |
| ASTM A 181/A 181M | (2000) Carbon Steel Forgings for General-Purpose Piping |
| ASTM A 234/A 234M | (2000) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service |
| ASTM B 395 | (1995) U-Bend Seamless Copper and Copper Alloy Heat Exchanger and Condenser Tubes |
| ASTM B 395M | (1995) U-Bend Seamless Copper and Copper Alloy Heat Exchanger and Condenser Tubes (Metric) |

ASME INTERNATIONAL (ASME)

- | | |
|------------|--|
| ASME B16.3 | (1998) Malleable Iron Threaded Fittings |
| ASME B16.5 | (1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24 |

ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B31.1	(1998) Power Piping
ASME BPV VIII Div 1	(1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5	(1994; CS5a-1995) Cross-Linked Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV
AEIC CS6	(1996) Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 kV

ELECTRICAL GENERATING SYSTEMS ASSOCIATION (EGSA)

EGSA 101P	(1995a) Engine Driven Generator Sets
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INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE Std 1	(1986; R 1992) General Principles for Temperature Limits in the Rating of Electric Equipment and for the Evaluation of Electrical Insulation
IEEE Std 48	(1998) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 100	(1997) IEEE Standard Dictionary of Electrical and Electronics Terms
IEEE Std 120	(1989) Electrical Measurements in Power Circuits
IEEE Std 404	(1993) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V Through 138 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V
IEEE Std 519	(1992) Harmonic Control in Electrical Power Systems

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA ICS 2	(1993) Industrial Controls and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC
NEMA ICS 6	(1993) Industrial Control and Systems, Enclosures
NEMA WC 7	(1988; Rev 3 1996) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	(1988; Rev 3 1996) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA MG 1	(1998) Motors and Generators
NEMA PB 1	(1995) Panelboards
NEMA SG 3	(1995) Power Switching Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(1996; Errata TIA 96-2) Flammable and Combustible Liquids Code
NFPA 37	(1998) Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	(1999) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE ARP 892	(1965; R 1994) D-C Starter-Generator, Engine
SAE J 537	(1996) Storage Batteries

UNDERWRITERS LABORATORIES (UL)

UL 489	(1996; Rev thru Dec 1998) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 891	(1994; Rev thru Jan 1995) Dead-Front Switchboards
UL 1236	(1994; Rev thru Mar 1999) Battery Chargers for Charging Engine-Starter Batteries

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Layout; G, RE
Drawings; G, RE

- a. Base-mounted equipment, complete with base and attachments including anchor bolt template and recommended clearances for maintenance and operation.
- b. Starting system.
- c. Fuel system.
- d. Cooling system.
- e. Exhaust system.
- f. Electric wiring of relays, breakers, programmable controllers, and switches including single line and wiring diagrams.
- g. Lubrication system, including piping, pumps, strainers, filters, heat exchangers for lube oil and turbocharger cooling, electric heater, controls and wiring.
- h. Location, type, and description of vibration isolation devices.
- i. The safety system, including wiring schematics.
- j. One-line schematic and wiring diagrams of the generator, exciter, regulator, governor, and all instrumentation.
- k. Panel layouts.
- l. Mounting and support for each panel and major piece of electrical equipment.

m. Engine-generator set rigging points and lifting instructions.

Acceptance; G, RE

Drawings which accurately depict the as-built configuration of the installation, upon acceptance of the LPG-generator set installation. Layout drawings shall be revised to reflect the as-built conditions and submitted with the as-built drawings.

SD-03 Product Data

Performance Tests;

Calculations of the engine and generator output power capability, including efficiency and parasitic load data.

Sound Limitations; G, RE

Sound power level data for the packaged unit operating at 100% load in a free field environment. The data should demonstrate compliance with the sound limitation requirements of this specification.

Generator;

Each generator KW rating and short circuit capacity (both symmetric and asymmetric).

LPG Storage Tank;

Capacity of tank shall be between 100 to 150 gallons..

Power Factor;

Generator capability curve showing generator kVA output (kW vs. kvar) for both leading and lagging power factors ranging from 0 to 1.0.

Heat Rejected to Engine-Generator Space;

Manufacturers data to quantify heat rejected to the space with the engine generator set at rated capacity.

Time-Delay on Alarms;

The magnitude of monitored values which define alarm or action setpoints, and the tolerance (plus and/or minus) at which the device activates the alarm or action.

Cooling System;

a. The maximum and minimum allowable inlet temperatures of the coolant fluid.

b. The maximum allowable temperature rise in the coolant fluid through the engine.

c. The minimum allowable inlet fuel temperature.

Manufacturer's Catalog;

Manufacturer's standard catalog data describing and depicting each engine-generator set and all ancillary equipment in sufficient detail to demonstrate specification compliance.

Vibration Isolation;

Vibration isolation system performance data for the range of frequencies generated by the engine-generator set during operation from no load to full load and the maximum vibration transmitted to the floor. Description of seismic qualification of the engine-generator mounting, base, and vibration isolation.

Instructions; G, RE

Instructions including: the manufacturer's pre-start checklist and precautions; startup procedures for test mode, manual-start mode, and automatic-start mode, (as applicable); running checks, procedures, and precautions; and shutdown procedures, checks, and precautions. Instructions shall include procedures for interrelated equipment (such as heat recovery systems, co-generation, load-shedding, and automatic transfer switches). Instructions shall be weatherproof, laminated in plastic, framed, and posted where directed. Posted data shall include wiring and control diagrams showing the key mechanical and electrical control elements, and a diagrammatic layout of the system.

Experience;

Statement showing that each component manufacturer has a minimum of 3 years experience in the manufacture, assembly and sale of components used with stationary LPG-engine generator sets for commercial and industrial use.

Statement showing that the engine-generator set manufacturer/assembler has a minimum of 3 years experience in the manufacture, assembly and sale of stationary LPG engine-generator sets for commercial and industrial use.

Field Engineer;

A letter listing the qualifications, schools, formal training, and experience of the field engineer.

Site Welding;

A letter listing the welder qualifying procedures for each welder, complete with supporting data such as test procedures used, what was tested to, and a list of the names of all welders and their qualifications symbols.

General Installation;

A complete copy of the manufacturer's installation procedures. A detailed description of the manufacturer's recommended break-in procedure.

Site Visit;

A site visit letter stating the date the site was visited and listing discrepancies found.

SD-06 Test Reports

Onsite Inspection and Tests; G, RE

a. A letter giving notice of the proposed dates of all onsite inspections and tests at least 14 days prior to beginning tests.

b. A detailed description of the Contractor's proposed procedures for onsite tests including the test including the test plan and a listing of equipment necessary to perform the tests. Submission shall be at least 7 days prior to beginning tests.

c. Six copies of the onsite test data described below in 8-1/2 x 11 inch 3-ring binders with a separate section for each test. Sections shall be separated by dividers with tabs. Data plots shall be full size 8-1/2 x 11 inches minimum), showing all grid lines, with full resolution.

- (1) A description of the procedures for onsite tests.
- (2) A list of equipment used, with calibration certifications.
- (3) A copy of measurements taken, with required plots and graphs.
- (4) The date of testing.
- (5) The parameters verified.
- (6) The condition specified for the parameter.
- (7) The test results, signed and dated.
- (8) A description of all adjustments made.

SD-07 Certificates

Vibration Isolation;

Torsional analysis including prototype testing or calculations which certify and demonstrate that no damaging or dangerous torsional vibrations will occur when the prime mover is connected to the generator, at synchronous speeds, plus/minus 10%.

Prototype Tests;

Manufacturer's standard certification that prototype tests were performed for the generator model proposed.

Reliability and Durability;

Documentation which cites engines and generators in similar service to demonstrate compliance with the requirements of this specification. Certification does not exclude annual

technological improvements made by a manufacturer in the basic standard model set on which experience was obtained, provided parts interchangeability has not been substantially affected and the current standard model meets all the performance requirements of this specification. For each different set, 2 like sets shall have performed satisfactorily in a stationary power application, independent and separate from the physical location of the manufacturer's and assembler's facilities, for a minimum of 2 consecutive years without any failure to start, including periodic exercise. The certification shall state that for the set proposed to meet this specification, there were no failures resulting in downtime for repairs in excess of 72 hours or any failure due to overheating during 2 consecutive years of service. Like sets are of the same model, speed, bore, stroke, number and configuration of cylinders, and output power rating. Like generators are of the same model, speed, pitch, cooling, exciter, voltage regulator and output power rating. A list shall be provided with the name of the installations, completion dates, and name and telephone number of a point of contact.

Emissions;

A certification from the engine manufacturer stating that the engine exhaust emissions meet federal, state, and local regulations and restrictions specified. At a minimum, this certification shall include emission factors for criteria pollutants including nitrogen oxides, carbon monoxide, particulate matter, sulfur dioxide, non-methane hydrocarbon, and for hazardous air pollutants (HAPs).

Sound limitations;

A certification from the manufacturer stating that the sound emissions meet the specification.

Flywheel Balance;

Manufacturer's certification that the flywheel has been statically and dynamically balanced and is capable of being rotated at 125% of rated speed without vibration or damage.

Materials and Equipment;

A letter stating that where materials or equipment are specified to comply with requirements of UL, or other standards, written proof of such compliance has been obtained. The label or listing of the specified agency, or a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency are acceptable as proof.

Factory Inspection and Tests;

A certification that each engine generator set passed the factory tests and inspections and a list of the test and inspections.

Inspections;

A letter certifying that all facilities are complete and functional, that each system is fully functional, and that each item of equipment is complete, free from damage, adjusted, and ready for beneficial use.

Cooling System;

Certification that the engine-generator set and cooling system function properly in the ambient temperatures specified.

1.3 SYSTEM DESCRIPTION

Each engine-generator set shall be provided and installed complete and totally functional, with all necessary ancillary equipment to include air filtration; starting system; generator controls, protection, and isolation; instrumentation; lubrication; fuel system; cooling system; and engine exhaust system. Each engine generator set shall satisfy the requirements specified in the Engine Generator Parameter Schedule.

1.3.1 Engine-Generator Parameter Schedule

ENGINE GENERATOR PARAMETER SCHEDULE

Service Load	45_kW
Power Factor	0.8 lagging
Motor Starting kVA (maximum)	_75 kVA
Maximum Speed	1800 rpm
Engine-Generator Application	stand-alone
Engine Cooling Type	water/ethylene glycol
Heat Exchanger Type	fin-tube
Governor Type	Isochronous
Frequency Bandwidth steady state	\pm 0.25%
Voltage Regulation (No load to full load)	\pm 2% (max.)
Voltage Bandwidth (steady state)	\pm 0.5%
Frequency	60 Hz
Voltage	120/240 volts
Phases	1 Phase
Max Time to Start and be Ready to	10 seconds

Assume Load

Max Allowable Heat Transferred To Engine Generator Space at Rated Output Capacity	1650 BTU/min.
Max Summer Outdoor Temp (Ambient)	115 degrees F
Min Winter Outdoor Temp (Ambient)	35 degrees F
Installation Elevation	2220 ft above sea level

1.3.2 Output Capacity

Each generator set shall provide power equal to the sum of service load plus the machine's efficiency loss and associated ancillary equipment loads. Rated output capacity shall also consider engine and/or generator oversizing required to meet requirements in paragraph Engine-Generator Parameter Schedule.

1.3.3 Power Rating

Standby ratings shall be in accordance with EGSA 101P.

1.4 GENERAL REQUIREMENTS

1.4.1 Engine-Generator Set

Each set shall consist of one engine, one generator, and one exciter, mounted, assembled, and aligned on one base; and all other necessary ancillary equipment which may be mounted separately. Sets shall be assembled and attached to the base prior to shipping. Set components shall be environmentally suitable for the locations shown and shall be the manufacturer's standard product offered in catalogs for commercial or industrial use. A generator strip heater shall be provided for moisture control when the generator is not operating.

1.4.2 Nameplates

Each major component of this specification shall have the manufacturer's name, type or style, model or serial number, and rating number on a plate secured to the equipment. As a minimum, nameplates shall be provided for: Engines; Relays; Generators; tank; Transformers (CT & PT); Regulators; Pumps and pump motors; Governors; Generator Breaker; Economizers; Heat exchangers (other than base-mounted).

Engines	Relays
Generators	LPG tank rated for outdoor use
Transformers (CT & PT)	Regulators
Pumps and pump motors	Governors
Generator Breaker	Economizers

Heat exchangers (other than base-mounted)

Where the following equipment is provided as a standard component by the LPG-engine generator set manufacturer, the nameplate information may be provided in the maintenance manual in lieu of nameplates.

Battery charger	Heaters
Exhaust mufflers	Exciters
Switchgear	Silencers
Battery	

1.4.3 Personnel Safety Device

Exposed moving parts, parts that produce high operating temperatures, parts which may be electrically energized, and parts that may be a hazard to operating personnel during normal operation shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. The safety devices shall be installed so that proper operation of the equipment is not impaired.

1.4.4 Verification of Dimensions

Before performing work, the premises shall be visited and details of the work verified. The Contracting Officer shall be advised in writing of any discrepancies before performing any work.

1.4.5 Conformance to Codes and Standards

Where equipment is specified to conform to requirements of any code or standard such as UL, the design, fabrication and installation shall conform to the code.

1.4.6 Site Welding

Structural members shall be welded in accordance with Section 05090 WELDING, STRUCTURAL. For all other welding, procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by a previously qualified employer may be accepted as permitted by ASME B31.1. Welder qualification tests shall be performed for each welder whose qualifications are not in compliance with the referenced standards. The Contracting Officer shall be notified 24 hours in advance of qualification tests. The qualification tests shall be performed at the work site if practical. The welder or welding operator shall apply the assigned personal symbol near each weld made as a permanent record.

1.4.7 Engine Generator Set Enclosure

The engine generator set enclosure shall be corrosion resistant and fully weather resistant. The enclosure shall contain all set components and provide ventilation to permit operation at rated load under secured conditions. Doors shall be provided for access to all controls and equipment requiring periodic maintenance or adjustment. Removable panels shall be provided for access to components requiring periodic replacement. The enclosure shall be capable of being removed without disassembly of the engine-generator set or removal of components other than exhaust system. The enclosure shall reduce the noise of the generator set to within the limits specified in the paragraph SOUND LIMITATIONS.

1.4.8 Vibration Isolation

The maximum engine-generator set vibration in the horizontal, vertical and axial directions shall be limited to 6 mils (peak-peak RMS), with an overall velocity limit of RMS, for all speeds through 110% of rated speed. The engine-generator set shall be provided with vibration-isolation in accordance with the manufacturer's standard recommendation. Where the vibration-isolation system does not secure the base to the unit foundation, seismic restraints shall be provided in accordance with the seismic parameters specified.

1.4.9 Experience

Each component manufacturer shall have a minimum of 3 years experience in the manufacture, assembly and sale of components used with stationary LPG engine-generator sets for commercial and industrial use. The engine-generator set manufacturer/assembler shall have a minimum of 3 years experience in the manufacture, assembly and sale of stationary LPG engine-generator sets for commercial and industrial use.

1.4.10 Field Engineer

The engine-generator set manufacturer or assembler shall furnish a qualified field engineer to supervise the complete installation of the engine-generator set, assist in the performance of the onsite tests, and instruct personnel as to the operational and maintenance features of the equipment. The field engineer shall have attended the engine-generator manufacturer's training courses on installation and operation and maintenance for engine generator sets.

1.4.11 Seismic Requirements

Seismic requirements shall be in accordance with Section 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT .

1.5 STORAGE AND INSTALLATION

The Contractor shall properly protect material and equipment in accordance with the manufacturers recommended storage procedures, before, during, and after installation. Stored items shall be protected from the weather and contamination. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.6 OPERATION AND MAINTENANCE MANUALS

The operation and maintenance manuals shall be submitted and approved prior to commencing onsite tests.

1.6.1 Operation Manual

Three copies of the [manufacturers standard operation manual] [operation manual in 8-1/2 x 11 inch three-ring binders shall be provided. Sections shall be separated by heavy plastic dividers with tabs which identify the material in the section. Drawings shall be folded blue lines, with the title block visible, and placed in 8-1/2 x 11 inch plastic pockets with reinforced holes]. The manual shall include:

- a. Step-by-step procedures for system startup, operation, and shutdown;

- b. Drawings, diagrams, and single-line schematics to illustrate and define the electrical, mechanical, and hydraulic systems with their controls, alarms, and safety systems;
- c. Procedures for interface and interaction with related systems to include automatic transfer switches.

1.6.2 Maintenance Manual

Three copies of the maintenance manual containing the information described below in 8-1/2 x 11 inch three-ring binders shall be provided. Each section shall be separated by a heavy plastic divider with tabs. Drawings shall be folded, with the title block visible, and placed in plastic pockets with reinforced holes.

- a. Procedures for each routine maintenance item. Procedures for troubleshooting. Factory-service, take-down overhaul, and repair service manuals, with parts lists.
- b. The manufacturer's recommended maintenance schedule.
- c. A component list which includes the manufacturer's name, address, type or style, model or serial number, rating, and catalog number for the major components listed in paragraph GENERAL REQUIREMENTS.
- d. A list of spare parts for each piece of equipment and a complete list of materials and supplies needed for operation.

1.7 SPECIAL TOOLS AND FILTERS

Two sets of special tools and two sets of filters required for maintenance shall be provided. Special tools are those that only the manufacturer provides, for special purposes, or to reach otherwise inaccessible parts. One handset shall be provided for each electronic governor when required to indicate and/or change governor response settings. Two complete sets of filters shall be supplied in a suitable storage box. these filters shall be in addition to filters replaced after testing.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be as specified.

2.1.1 Circuit Breakers, Low Voltage

NEMA AB 1, UL 489, and NEMA SG 3.

2.1.2 Filter Elements (Fuel-oil, Lubricating-oil, and Combustion-air)

Manufacturer's standard.

2.1.3 Instrument Transformers

ANSI C12.11.

2.1.4 Pipe (Sleeves, Fuel/Lube-oil, Compressed-Air, Coolant and Exhaust)

ASTM A 53/A 53M, ASTM A 106 or ASTM A 135, steel pipe. Pipe smaller than 2 inches shall be Schedule 80. Pipe 2 inches and larger shall be Schedule 40.

2.1.5 Pipe Flanges and Fittings

- a. Pipe Flanges and Flanged Fittings: ASTM A 181/A 181M, Class 60, or ASME B16.5, Grade 1, Class 150.
- b. Pipe Welding Fittings: ASTM A 234/A 234M, Grade WPB or WPC, Class 150, or ASME B16.11, 3000 lb.
- c. Threaded Fittings: ASME B16.3, Class 150.
- d. Valves: MSS SP-80, Class 150.
- e. Gaskets: Manufacturers Standard.

2.1.6 Pipe Hangers

MSS SP-58 and MSS SP-69.

2.1.7 Electrical Enclosures

2.1.7.1 General

NEMA ICS 6.

2.1.7.2 Panelboards

NEMA PB 1.

2.1.8 Electric Motors

Electric motors shall conform to the requirements of NEMA MG 1. Motors shall have sealed ball bearings, a maximum speed of 1800 rpm and integral automatic or manual reset thermal overload protectors. Motors used outside shall be totally enclosed. AC motors larger than 1/2 Hp shall be of the squirrel cage induction type for standard voltage of 230 volts, 60 Hz single phase power. AC motors 1/2 Hp or smaller, shall be for standard voltage 115 volts, 60 Hz, single phase power.

2.1.9 Motor Controllers

Motor controllers and starters shall conform to the requirements of NFPA 70 and NEMA ICS 2.

2.2 ENGINE

Each engine shall operate on LPG, shall be designed for stationary applications and shall be complete with ancillaries. The engine shall be a standard production model described in the manufacturer's catalog. The engine shall be turbocharged. The engine shall be four-stroke-cycle and Individual Coil Near Plug-ignition type. The engine shall be V-, or opposed-piston type, with a solid cast block or individually cast cylinders. The engine shall have a minimum of two cylinders. Opposed-piston type engines shall have no less than four cylinders. Each block shall have a coolant drain port. Each engine shall be equipped with an overspeed sensor.

2.3 FUEL SYSTEM

The fuel system for engine generator set shall be LPG.

2.3.1 Relief Valve

A relief valve shall be provided to regulate pressure in the fuel tank, and prevent the build-up of excessive pressure in the fuel tank system.

2.3.2 LPG Outdoor Tank

The engine shall be provided with an above ground tank. The LPG tank shall be factory installed and provided as recommended by the tank manufacturer. The LPG tank shall be provided with connections for supply line, pressure regulator, local fill port, pressure gage, concrete foundation support and concrete enclosure..

2.3.2.1 Capacity

Tank shall have capacity to supply fuel to the engine for an uninterrupted 4-hour period at 100% rated load without being refilled.

2.3.2.2 Local Fuel Fill

Tank shall be provided with a filler nozzle and isolation valve..

2.4 LUBRICATION

Each engine shall have a separate lube-oil system conforming to NFPA 30 and NFPA 37. Each system shall be pressurized by engine-driven oil pumps. Each system shall be furnished with a relief valve for oil pressure regulation (for closed systems) and a dip-stick for oil level indications. The crankcase shall be vented in accordance with the manufacturer's recommendation except that it shall not be vented to the engine exhaust system. Crankcase breathers, if provided on engines installed in buildings or enclosures, shall be piped to vent to the outside. The system shall be readily accessible for service such as draining, refilling, etc. Each system shall permit addition of oil and have oil-level indication with the set operating. The system shall utilize an oil cooler as recommended by the engine manufacturer.

2.4.1 Filter

One full-flow filter shall be provided for each pump. The filter shall be readily accessible and capable of being changed without disconnecting the piping or disturbing other components. The filter shall have inlet and outlet connections plainly marked.

2.4.2 Lube-Oil Sensors

Each engine shall be equipped with lube-oil pressure sensors. Pressure sensors shall be located downstream of the filters and provide signals for required indication and alarms.

2.5 COOLING SYSTEM

Each engine cooling system shall operate automatically while the engine is running. Each cooling system shall be sized for the maximum summer outdoor

design temperature and site elevation. Water-cooled system coolant shall use a combination of water and ethylene-glycol sufficient for freeze protection at the minimum winter outdoor temperature specified. The maximum temperature rise of the coolant across the engine shall be no more than that recommended and submitted in accordance with paragraph SUBMITTALS.

2.5.1 Coolant Pumps

Coolant pumps shall be the centrifugal type. Each engine shall have an engine-driven primary pump. Secondary pumps shall be electric motor driven and have automatic controllers.

2.5.2 Heat Exchanger

Each heat exchanger shall be of a size and capacity to limit the maximum allowable temperature rise in the coolant across the engine to that recommended and submitted in accordance with paragraph SUBMITTALS for the maximum summer outdoor design temperature and site elevation. Each heat exchanger shall be corrosion resistant, suitable for service in ambient conditions of application.

2.5.2.1 Fin-Tube-Type Heat Exchanger (Radiator)

Heat exchanger may be factory coated with corrosive resistant film providing that corrosion measures are taken to restore the heat rejection capability of the radiator to the initial design requirement via oversizing, or other compensating methods. Internal surfaces shall be compatible with liquid fluid coolant used. Materials and coolant are subject to approval by the Contracting Officer. Heat exchangers shall be pressure type incorporating a pressure valve, vacuum valve and a cap. Caps shall be designed for pressure relief prior to removal. Each heat exchanger and the entire cooling system shall be capable of withstanding a minimum pressure of 7 psi. Each heat exchanger shall be protected with a strong grille or screen guard. Each heat exchanger shall have at least two tapped holes. One tapped hole in the heat exchanger shall be equipped with a drain cock, the rest shall be plugged.

2.5.3 Ductwork

A flexible connection shall be used to connect the duct to the LPG engine radiator. Material for the connection shall be wire-reinforced glass. The connection shall be rendered practically airtight.

2.5.4 Temperature Sensors

Each engine shall be equipped with coolant temperature sensors. Temperature sensors shall provide signals for pre-high and high indication and alarms.

2.6 SOUND LIMITATIONS

The noise generated by the installed LPG generator set operating at 100 percent load shall not exceed the following sound pressure levels in any of the indicated frequencies when measured at a distance of 75 feet from the end of the exhaust and air intake piping directly along the path of intake and discharge for horizontal piping; or at a radius of 75 feet from the engine at 45 degrees apart in all directions for vertical piping.

Frequency Band (Hz)	Maximum Acceptable Pressure Level (Decibels)
31	87
63	87
125	77
250	70
500	64
1,000	61
2,000	60
4,000	60
8,000	62

2.7 AIR INTAKE EQUIPMENT

Filters and silencers shall be provided in locations that are convenient for servicing. The silencer shall be of the high-frequency filter type, located in the air intake system as recommended by the engine manufacturer.

Silencer shall be capable of reducing the noise level at the air intake to a point below the maximum acceptable levels specified in paragraph SOUND LIMITATIONS. A combined filter-silencer unit meeting requirements for the separate filter and silencer items may be provided. Expansion elements in air-intake lines shall be copper.

2.8 EXHAUST SYSTEM

The system shall be separate and complete for each engine. Piping shall be supported so as to minimize vibration. Where a V-type engine is provided, a V-type connector with necessary flexible sections and hardware shall connect the engine exhaust outlets.

2.8.1 Flexible Sections and Expansion Joints

A flexible section at each engine and an expansion joint at each muffler shall be provided. Flexible sections and expansion joints shall have flanged connections. Flexible sections shall be made of convoluted seamless tube without joints or packing. Expansion joints shall be the bellows type. Expansion and flexible elements shall be stainless steel suitable for LPG-engine exhaust gas at the maximum exhaust temperature that is specified by the engine manufacturer. Expansion and flexible elements shall be capable of absorbing vibration from the engine and compensation for thermal expansion and contraction.

2.8.2 Exhaust Muffler

A chamber type exhaust muffler shall be provided. The muffler shall be constructed of welded steel and designed for outside horizontal mounting. Eyebolts, lugs, flanges, or other items shall be provided as necessary for support in the location and position indicated. Pressure drop through the muffler shall not exceed the recommendations of the engine manufacturer. Outside mufflers shall be zinc coated or painted with high temperature 400 degrees F resisting paint. The muffler and exhaust piping together shall reduce the noise level to less than the maximum acceptable level listed for sound limitations in paragraph SOUND LIMITATIONS. The muffler shall have a drain valve, nipple, and cap at the low-point of the muffler.

2.8.3 Exhaust Piping

Horizontal sections of exhaust piping shall be sloped downward away from the engine to a condensate trap and drain valve. Changes in direction shall be long-radius. Exhaust piping, mufflers and silencers installed inside any building shall be insulated in accordance with paragraph THERMAL INSULATION and covered to protect personnel. Vertical exhaust piping shall be provided with a hinged, gravity operated, self-closing, rain cover.

2.9 EMISSIONS

The finished installation shall comply with Federal, state, and local regulations and restrictions regarding the limits of emissions

2.10 STARTING SYSTEM

The starting system for standby engine generator sets used in emergency applications shall be in accordance with NFPA 99 and NFPA 110 and as follows.

2.10.1 Controls

An engine control switch shall be provided with functions including: run/start (manual), off/reset, and automatic mode. Start-stop logic shall be provided for adjustable cycle cranking and cool down operation. The logic shall be arranged for manual starting and fully automatic starting in accordance with paragraph AUTOMATIC ENGINE-GENERATOR SET SYSTEM OPERATION. Electrical starting systems shall be provided with an adjustable cranking limit device to limit cranking periods from 1 second up to the maximum duration.

2.10.2 Capacity

The starting system shall be of sufficient capacity, at the maximum outdoor summer temperature specified to crank the engine without damage or overheating. The system shall be capable of providing a minimum of three cranking periods with 15-second intervals between cranks. Each cranking period shall have a maximum duration of 15 seconds.

2.10.3 Functional Requirements

Starting system shall be manufacturers recommended dc system utilizing a negative circuit ground. Starting motors shall be in accordance with SAE ARP 892.

2.10.4 Battery

A starting battery system shall be provided and shall include the battery, battery rack, intercell connectors, and spacers. The battery shall be in accordance with SAE J 537. Critical system components (rack, protection, etc.) shall be sized to withstand the seismic acceleration forces specified. The battery shall be lead-acid type, with sufficient capacity, at the minimum outdoor winter temperature specified to provide the specified cranking periods. Valve-regulated lead-acid batteries are not acceptable.

2.10.5 Battery Charger

A current-limiting battery charger, conforming to UL 1236, shall be provided and shall automatically recharge the batteries. The charger shall

be capable of an equalize charging rate for recharging fully depleted batteries within 24 hours and a float charge rate for maintaining the batteries in prime starting condition. An ammeter shall be provided to indicate charging rate. A timer shall be provided for the equalize charging rate setting. A battery is considered to be fully depleted when the output voltage falls to a value which will not operate the engine generator set and its components.

2.10.6 Starting Aids

The manufacturer shall provide one or more of the following methods to assist engine starting.

2.10.6.1 Glow Plugs

Glow plugs shall be designed to provide sufficient heat for combustion of fuel within the cylinders to guarantee starting at an ambient temperature of minus 25 degrees F.

2.10.6.2 Jacket-Coolant Heaters

A thermostatically controlled electric heater shall be mounted in the engine coolant jacketing to automatically maintain the coolant within plus or minus 3 degrees of the control temperature. The heater shall operate independently of engine operation so that starting times are minimized. The control temperature shall be the temperature recommended by the engine manufacturer to meet the starting time specified.

2.11 GOVERNOR

Each engine shall be provided with a governor which maintains the frequency within a bandwidth of the rated frequency, over a steady-state load range of zero to 100% of rated output capacity. The governor shall be configured for safe manual adjustment of the speed/frequency during operation of the engine generator set, without special tools, from 90 to 110 % of the rated speed/frequency, over a steady state load range of zero to 100% of rated capacity. Isochronous governors shall maintain the midpoint of the frequency bandwidth at the same value for steady-state loads over the range of zero to 100% of rated output capacity.

2.12 GENERATOR

Each generator shall be of the synchronous type, one or two bearing, conforming to NEMA MG 1, equipped with winding terminal housings in accordance with NEMA MG 1, equipped with an amortisseur winding, and directly connected to the engine. Insulation shall be Class H. Generator design shall protect against mechanical, electrical and thermal damage due to vibration, 25 percent overspeeds, or voltages and temperatures at a rated output capacity of 100 percent. Generator ancillary equipment shall meet the short circuit requirements of NEMA MG 1. Frames shall be the drip-proof type.

2.12.1 Current Balance

At 100 percent rated load, and load impedance equal for each of the three phases, the permissible current difference between any two phases shall not exceed 2 percent of the largest current on either of the two phases.

2.12.2 Voltage Balance

At any balanced load between 75 and 100 percent of rated load, the difference in line-to-neutral voltage among the three phases shall not exceed 1 percent of the average line-to-neutral voltage. For a single-phase load condition, consisting of 25 percent load at unity power factor placed between any phase and neutral with no load on the other two phases, the maximum simultaneous difference in line-to-neutral voltage between the phases shall not exceed 3 percent of rated line to neutral voltage. The single-phase load requirement shall be valid utilizing normal exciter and regulator control. The interpretation of the 25 percent load for single phase load conditions means 25 percent of rated current at rated phase voltage and unity power factor.

2.12.3 Waveform

The deviation factor of the line-to-line voltage at zero load and at balanced full rated load at 0.8 power factor shall not exceed 10%. The RMS of all harmonics shall be less than 5.0% and that of any one harmonic less than 3.0% at full rated load. Each engine-generator shall be designed and configured to meet the total harmonic distortion limits of IEEE Std 519.

2.13 EXCITER

The generator exciter shall be of the brushless type. Semiconductor rectifiers shall have a minimum safety factor of 300% for peak inverse voltage and forward current ratings for all operating conditions, including 110% generator output at 104 degrees F ambient. The exciter and regulator in combination shall maintain generator-output voltage within the limits specified.

2.14 VOLTAGE REGULATOR

Each generator shall be provided with a solid-state voltage regulator, separate from the exciter. The regulator shall maintain the voltage within a bandwidth of the rated voltage, over a steady-state load range of zero to 100% of rated output capacity. Regulator shall be configured for safe manual adjustment of the engine generator voltage output without special tools, during operation from 90 to 110% of the rated voltage over the steady state load range of zero to 100% of rated output capacity. Regulation drift shall not exceed plus or minus 0.5% for an ambient temperature change of 36 degrees F.

2.14.1 Steady State Performance (Regulation or Voltage Droop).

The voltage regulator shall have a maximum droop of 2% of rated voltage over a load range from 0 to 100% of rated output capacity and automatically maintain the generator output voltage within the specified operational bandwidth.

2.15 GENERATOR PROTECTION

Short circuit and overload protection for the generator shall be provided. The generator circuit breaker (IEEE Device 52) ratings shall be consistent with the generator rated voltage and frequency, with continuous, short circuit and interrupting current ratings to match the generator capacity. The manufacturer shall determine the short circuit current interrupting rating of the breaker. The breaker shall be engine generator base mounted by the engine-generator set manufacturer. Molded case breakers shall be provided with shunt trip. Surge protection shall be provided for each

phase of the generator, to be mounted at the generator terminals.

2.15.1 Panelboards

Panelboards shall be metal-enclosed, general purpose, 1-phase, 3-wire, 600 volt rated, with neutral bus and continuous ground bus, conforming to NEMA PB 1 and UL 891. Neutral bus and ground bus capacity shall be full capacity.

Enclosure designs, construction, materials and coatings shall be suitable for the application and environment. Bus continuous current rating shall be at least equal to the generator rating and correspond to UL listed current ratings specified for panelboards and switchboards. Current withstand rating (short circuit rating) shall match the generator capacity.

Buses shall be copper.

2.15.2 Devices

Switches, circuit breakers, switchgear, fuses, relays, and other protective devices shall be as recommended by the manufacturer.

2.16 SAFETY SYSTEM

Devices, wiring, remote panels, local panels, etc., shall be provided and installed as a complete system to automatically activate the appropriate signals and initiate the appropriate actions. The safety system shall be provided with a self-test method to verify its operability. Alarm signals shall have manual acknowledgement and reset devices. The alarm signal systems shall reactivate for new signals after acknowledgment is given to any signal. The systems shall be configured so that loss of any monitoring device shall be dealt with as an alarm on that system element.

2.16.1 Audible Signal

The audible alarm signal shall sound at a frequency of 70 Hz at a volume of 10 feet. The sound shall be continuously activated upon alarm and silenced upon acknowledgment.

2.16.2 Visual Signal Signal

The visual alarm signal shall be a panel light. The light shall be normally off, activated to be blinking upon alarm. The light shall change to continuously light upon acknowledgement. If automatic shutdown occurs, the display shall maintain activated status to indicate the cause of failure and shall not be reset until cause of alarm has been cleared and/or restored to normal condition. Shutdown alarms shall be red; all other alarms shall be amber.

2.16.3 Alarms and Action Logic

2.16.3.1 Shutdown

Simultaneous activation of the audible signal, activation of the visual signal, stopping the engine, and opening the generator main circuit breakers shall be accomplished.

2.16.3.2 Problem

Activation of the visual signal shall be accomplished.

2.16.4 Local Alarm Panel

A local alarm panel shall be provided with the following shutdown and alarm functions [in accordance with NFPA 99 and including the listed Corps of Engineers requirements, mounted either on or adjacent to the engine generator set.

Device/ Condition/ Function	What/Where/Size	NFPA 99	NFPA 110 Level 1	NFPA 110 Level 2	Corps of Engrs Required
Shutdowns W/Alarms					
High engine temperature	Automatic/ jacket water/ cylinder	SD/CP VA	SD/CP VA	SD/CP VA	SD VA
Low lube-oil pressure	Automatic/ pressure/ level	SD/CP VA	SD/CP VA	SD/CP VA	SD VA
Overspeed shutdown \$ alarm	(110% (+ 2%) of rated speed	SD/CP VA	SD/CP VA	SD/CP VA	SD VA
Overcrank failure to start	Automatic/ Failure to to start	SD/CP VA	SD/CP VA	SD/CP VA	
Air shutdown damper (200-600kW)	When used		SD/CP VA	SD/CP VA	
Red emergency stop switch	Manual Switch		SD/CP VA	SD/CP VA	SD VA
Failure to crank	Corps of Engrs. Required				
Alarms					
Low lube-oil pressure	Pressure/ level	CP VA	CP VA	CP VAO	CP VA
Low coolant	Jacket water	CP/VA	CP VA	CP VA	
Pre-high temperature	Jacket water/ cylinder	CP VA	CP VA	CP VAO	CP VA
Pre-low lube-oil pressure		CP VA			CP VA
High battery			CP VA	CP VAO	

Device/ Condition/ Function voltage	What/Where/Size	NFPA 99	NFPA 110 Level 1	NFPA 110 Level 2	Corps of Engrs Required
Low battery voltage			CP VA	CP VAO	
Battery charger AC failure	AC supply not available		CP VA	CP VAO	
Control switch not in AUTO			CP VA	CP VAO	
Low starting air pressure			CP VA	CP VAO	
Low starting hydraulic pressure			CP VA	CP VAO	

SD - Shut Down
 CP - On Control Panel
 VA - Visual Alarm
 AA - Audible Alarm
 O - Optional]

2.16.5 Time-Delay on Alarms

For startup of the engine-generator set, time-delay devices shall be installed bypassing the low lubricating oil pressure alarm during cranking, and the coolant-fluid outlet temperature alarm. The lube-oil time-delay device shall return its alarm to normal status after the engine starts. The coolant time-delay device shall return its alarm to normal status 5 minutes after the engine starts.

2.17 ENGINE GENERATOR SET CONTROLS AND INSTRUMENTATION

Devices, wiring, remote panels, local panels, etc., shall be provided and installed as a complete system to automatically activate the appropriate signals and initiate the appropriate actions.

2.17.1 Controls

A local control panel shall be provided with controls as indicated per the manufacture either on or adjacent to the engine generator set.

Device/Condition/ Function	Corps Requirement	NFPA 110 Level 1	NFPA 110 Level 2	MFG Offering
Controls				
Switch: run/start - off/set - auto	CP			CP/STD
Emergency stop switch & alarm	CP			CP/STD
Lamp test/indicator test	CP	CP VA	CP VA	CP/STD

Device/Condition/ Function	Corps Requirement	NFPA 110 Level 1	NFPA 110 Level 2	MFG Offering
Common alarm contacts/ fault relay		X	X	CP/O
Panel lighting	CP			CP/STD
Audible alarm & silencing/reset switch	CP			
Voltage adjust for voltage Regulator	CP			CP/STD
Pyrometer display w/selector switch	CP			
Remote emergency stop switch		CP VA	CP VA	
Remote fuel shutoff switch				
Remote lube-oil shutoff switch				

2.17.2 Engine Generator Set Metering and Status Indication

A local panel shall be provided with devices as indicated per the manufacture either on or adjacent to the engine generator set.

Device/Condition/ Function	Corps Requirement	NFPA 110 Level 1	NFPA 110 Level 2	MFG Offering
Genset Status & Metering				
Genset supplying load		CP VA	CP VAO	CP VAO
System ready				CP/STD
Engine oil pressure	CP			CP/STD
Engine coolant temperature	CP			CP/STD
Engine RPM (Tachometer)	CP			CP/STD
Engine run hours	CP			CP/STD
Pyrometer display w/selector switch	CP			
AC volts (generator), 3-phase	CP			CP/STD
AC amps (generator), 3-phase	CP			CP/STD
Generator frequency	CP			CP/STD
Phase selector switches (amps & volts)	CP			CP/STD
Watts/kW				CP/VA-O
Voltage Regulator Adjustment	CP			

Device/Condition/ Function	Corps Requirement	NFPA 110 Level 1	NFPA 110 Level 2	MFG Offering
CP - On Control Panel				
VA - Visual Alarm				
AA - Audible Alarm				
O - Optional				
STD - Manufacturers Standard Offering				

2.18 PANELS

Each panel shall be of the type necessary to provide specified functions. Panels shall be mounted on the engine generator set base by vibration/shock absorbing type mountings. Instruments shall be mounted flush or semiflush.

Convenient access to the back of instruments shall be provided to facilitate maintenance. Instruments shall be calibrated using recognized industry calibration standards. Each panel shall be provided with a panel identification plate which clearly identifies the panel function as indicated. Each instrument and device on the panel shall be provided with a plate which clearly identifies the device and its function as indicated. Panels except the remote alarm panel can be combined into a single panel.

2.18.1 Enclosures

Enclosures shall be designed for the application and environment, conforming to NEMA ICS 6, and provided with locking mechanisms which are keyed alike.

2.18.2 Analog

Analog electrical indicating instruments shall be in accordance with ANSI C39.1 with semiflush mounting. Switchgear, and control-room panel-mounted instruments shall have 250 degree scales with an accuracy of not less than 1 percent. Unit-mounted instruments shall be the manufacturer's standard with an accuracy of not less than 2 percent. The instrument's operating temperature range shall be minus 20 to plus 65 degrees C. Distorted generator output voltage waveform of a crest factor less than 5 shall not affect metering accuracy for phase voltages, hertz and amps.

2.18.3 Electronic

Electronic indicating instruments shall be true RMS indicating, 100 percent solid state, microprocessor controlled to provide all specified functions. Control, logic, and function devices shall be compatible as a system, sealed, dust and water tight, and shall utilize modular components with metal housings and digital instrumentation. An interface module shall be provided to decode serial link data from the electronic panel and translate alarm, fault and status conditions to set of relay contacts. Instrument accuracy shall be not less than 2 percent for unit mounted devices and 1 percent for control room, panel mounted devices, throughout a temperature range of minus 20 to plus 65 degrees C. Data display shall utilize LED or back lit LCD. Additionally, the display shall provide indication of cycle programming and diagnostic codes for troubleshooting. Numeral height shall be 1/2 inch.

2.18.4 Parameter Display

Indication or readouts of the lubricating-oil pressure, ac voltmeter, ac ammeter, frequency meter, and coolant temperature.

2.19 SURGE PROTECTION

Electrical and electronic components shall be protected from, or designed to withstand the effects of surges from switching and lightning.

2.20 AUTOMATIC ENGINE-GENERATOR-SET SYSTEM OPERATION

Fully automatic operation shall be provided for the following operations: engine-generator set starting and source transfer upon loss of normal source; retransfer upon restoration of the normal source; sequential starting; and stopping of each engine-generator set after cool down. Devices shall automatically reset after termination of their function.

2.20.1 Automatic Transfer Switch

Automatic transfer switches shall be in accordance with Section 16410 AUTOMATIC TRANSFER SWITCHE.

2.20.2 Monitoring and Transfer

Devices shall be provided to monitor voltage and frequency for the normal power source and engine generator set, and control transfer from the normal source and retransfer upon restoration of the normal source. Functions, actuation, and time delays shall be as described in Section 16410 AUTOMATIC TRANSFER SWITCHE.

2.21 MANUAL ENGINE-GENERATOR SET SYSTEM OPERATION

Complete facilities shall be provided for manual starting and testing of each set without load, loading and unloading of each set.

2.22 BASE

The base shall be constructed of steel. The base shall be designed to rigidly support the engine-generator set, ensure permanent alignment of all rotating parts, be arranged to provide easy access to allow changing of lube-oil, and ensure that alignment will be maintained during shipping and normal operation. The base shall permit skidding in any direction during installation and shall be provided with suitable holes for foundation bolts. The base shall also withstand and mitigate the effects of synchronous vibration of the engine and generator, and shall be provided with suitable holes for anchor bolts and jacking screws for leveling.

2.23 THERMAL INSULATION

Thermal insulation shall be as recommended by the manufacturer.

2.24 PAINTING AND FINISHING

The engine-generator set shall be cleaned, primed and painted in accordance with the manufacturer's standard color and practice.

2.25 FACTORY INSPECTION AND TESTS

Factory inspection and tests shall be performed on each engine-generator set proposed to meet this specification section. Inspections shall be completed and necessary repairs made prior to testing. Inspectors shall look for leaks, looseness, defects in components, and proper assembly. Factory tests shall be NEMA MG 1 routine tests and the manufacturers

routine tests.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION

Installation shall provide clear space for operation and maintenance in accordance with NFPA 70 and IEEE C2. Installation of pipe, duct, conduit, and ancillary equipment shall be configured to facilitate easy removal and replacement of major components and parts of the engine-generator set.

3.2 PIPING INSTALLATION

3.2.1 General

Piping shall be welded. Connections at valves shall be flanged. Connections at equipment shall be flanged except that connections to the LPG engine may be threaded if the LPG-engine manufacturer's standard connection is threaded. Except as otherwise specified, flanged fittings shall be utilized to allow for complete dismantling and removal of each piping system from the facility without disconnecting or removing any portion of any other system's equipment or piping. Connections to all equipment shall be made with flexible connectors. Pipes extending through the roof shall be properly flashed. Piping shall be installed clear of windows, doors, and openings to permit thermal expansion and contraction without damage to joints or hangers, and with a 1/2 inch drain valve at each low point.

3.2.2 Supports

Hangers, inserts, and supports shall be of sufficient size to accommodate any insulation and shall conform to MSS SP-58 and MSS SP-69. Supports shall be spaced not more than 7 feet on center for pipes 2 inches in diameter or less, not more than 12 feet on center for pipes larger than 2 inches but no larger than 4 inches, and not more than 17 feet on center for pipes larger than 4 inches in diameter. Supports shall be provided at pipe bends or change of direction.

3.2.3 Flanged Joints

Flanges shall be 125 pound type, drilled, and of the proper size and configuration to match equipment and LPG-engine connections. Gaskets shall be factory cut in one piece 1/16 inch thick.

3.2.4 Cleaning

After fabrication and before assembly, piping interiors shall be manually wiped clean of all debris.

3.2.5 Pipe Sleeves

Pipes passing through construction such as ceilings, floors, or walls shall be fitted with sleeves. Each sleeve shall extend through and be securely fastened in its respective structure and shall be cut flush with each surface. The structure shall be built tightly to the sleeve. The inside diameter of each sleeve shall be 1/2 inch, and where pipes pass through combustible materials, 1 inch larger than the outside diameter of the passing pipe or pipe covering.

3.3 ELECTRICAL INSTALLATION

Electrical installation shall comply with NFPA 70, IEEE C2, and Section 16415 ELECTRICAL WORK, INTERIOR.

3.3.1 Vibration Isolation

Flexible fittings shall be provided for all conduit, cable trays, and raceways attached to engine-generator sets. Metallic conductor cables installed on the engine generator set and from the engine generator set to equipment not mounted on the engine generator set shall be flexible stranded conductor. Terminations of conductors on the engine generator set shall be crimp-type terminals or lugs.

3.4 ONSITE INSPECTION AND TESTS

3.4.1 Test Conditions

3.4.1.1 Data

Measurements shall be made and recorded of parameters necessary to verify that each set meets specified parameters. If the results of any test step are not satisfactory, adjustments or replacements shall be made and the step repeated until satisfactory results are obtained. Unless otherwise indicated, data shall be taken during engine-generator set operation and recorded in 15 minute intervals and shall include: readings of engine-generator set meters and gauges for electrical and power parameters; oil pressure; ambient temperature; and engine temperatures available from meters and gauges supplied as permanent equipment on the engine-generator set. In the following tests where measurements are to be recorded after stabilization of an engine-generator set parameter (voltage, frequency, current, temperature, etc.), stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings. Electrical measurements shall be performed in accordance with IEEE Std 120. Definitions and terms are in accordance with IEEE Std 100. Temperature limits in the rating of electrical equipment and for the evaluation of electrical insulation shall be in accordance with IEEE Std 1.

3.4.1.2 Power Factor

Engine-generator set operating tests shall be made utilizing a load with the power factor specified in the engine generator set parameter schedule.

3.4.1.3 Contractor Supplied Items

The Contractor shall provide all equipment and supplies required for inspections and tests including fuel, test instruments, and loadbanks at the specified power factors.

3.4.1.4 Instruments

Readings of panel gauges, meters, displays, and instruments, provided under this specification shall be verified during test runs by test instruments of precision and accuracy greater than the tested items. Test instrument accuracy shall be at least as follows: current, 1.5%; voltage, 1.5%; real power, 1.5%; reactive power, 1.5%; power factor, 3%; frequency, 0.5%. Test instruments shall be calibrated by a recognized standards laboratory within [30] [90] days prior to testing.

3.4.1.5 Sequence

The sequence of testing shall be as specified in the approved testing plan unless variance is authorized by the Contracting Officer. Field testing shall be performed in the presence of the Contracting Officer. Tests may be scheduled and sequenced in order to optimize run-time periods; however the following general order of testing shall be followed: Construction Tests; Inspections; Safety run Tests; and Performance Tests and Final Inspection.

3.4.2 Construction Tests

Individual component and equipment functional tests for fuel piping, coolant piping, and lubricating-oil piping, electrical circuit continuity, insulation resistance, circuit protective devices, and equipment not provided by the engine-generator set manufacturer shall be performed prior to connection to the engine-generator set.

3.4.2.1 Piping Test

- a. Lube-oil and fuel-oil piping shall be flushed with the same type of fluid intended to flow through the piping, until the outflowing fluid has no obvious sediment or emulsion.
- b. Fuel piping which is external to the engine-generator set shall be tested in accordance with NFPA 30. All remaining piping which is external to the engine generator set shall be pressure tested with air pressure at 150% of the maximum anticipated working pressure, but in no case less than 150 psig, for a period of 2 hours to prove the piping has no leaks. If piping is to be insulated, the test shall be performed before the insulation is applied.

3.4.2.2 Electrical Equipment Tests

- a. Low-voltage cable insulation integrity tests shall be performed for cables connecting the generator breaker to the automatic transfer switch, panelboard, and main disconnect switch. Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations of conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 304,800 / (\text{length of cable in meters})$.

$(R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 1000 / (\text{length of cable in feet}))$

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

- c. Ground-Resistance Tests. The resistance of each grounding electrode system shall be measured using the fall-of-potential

method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

1) Single rod electrode - 25 ohms.

- d. Circuit breakers and switchgear shall be examined and tested in accordance with manufacturer's published instructions for functional testing.

3.4.3 Inspections

The following inspections shall be performed jointly by the Contracting Officer and the Contractor, after complete installation of each engine-generator set and its associated equipment, and prior to startup of the engine-generator set. Checks applicable to the installation shall be performed. The results of those which are physical inspections (I) shall be documented by the Contractor and submitted in accordance with paragraph SUBMITTALS. The Contractor shall present manufacturer's data for the inspections designated (D) at the time of inspection. Inspections shall verify that equipment type, features, accessibility, installation and condition are in accordance with the contract specification. Manufacturer's statements shall certify provision of features which cannot be verified visually.

1. Drive belts. (I)
2. Governor type and features. (I)
3. Engine timing mark. (I)
4. Starting motor. (I)
5. Starting aids. (I)
6. Coolant type and concentration. (D)
7. Radiator drains. (I)
8. Block coolant drains. (I)
9. Coolant fill level. (I)
10. Coolant line connections. (I)
11. Coolant hoses. (I)
12. Combustion air filter. (I)
13. Intake air silencer. (I)
14. Lube oil type. (D)
15. Lube oil drain. (I)
16. Lube-oil filter. (I)
17. Lube-oil-fill level. (I)
18. Lube-oil line connections. (I)
19. Lube-oil lines. (I)
20. Fuel type. (D)
21. Fuel-level. (I)
22. Fuel-line connections. (I)
23. Fuel lines. (I)
24. Fuel filter. (I)
25. Access for maintenance. (I)
26. Voltage regulator. (I)
27. Battery-charger connections. (I)
28. Wiring & terminations. (I)
29. Instrumentation. (I)

- 30. Hazards to personnel. (I)
- 31. Base. (I)
- 32. Nameplates. (I)
- 33. Paint. (I)
- 34. Exhaust system. (I)
- 35. Access provided to controls. (I)
- 36. Enclosure. (I)
- 37. Engine & generator mounting bolts (proper application). (I)

3.4.4 Safety Run Tests

- a. Perform and record engine manufacturer's recommended prestarting checks and inspections.
- b. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.
- c. Activate the manual emergency stop switch and verify that the engine stops.
- d. Remove the high and pre-high lubricating oil temperature sensing elements from the engine and temporarily install temperature gauge in their normal locations on the engine (required for safety, not for recorded data). Where necessary, provide temporary wiring harness to connect the sensing elements to their permanent electrical leads.
- e. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set at no load until the output voltage and frequency stabilize. Monitor the temporarily installed temperature gauges. If temperature reading exceeds the value for an alarm condition, activate the manual emergency stop switch.
- f. Immerse the elements in a vessel containing controlled-temperature hot oil and record the temperature at which the pre-high alarm activates and the temperature at which the engine shuts down. Remove the temporary temperature gauges and reinstall the temperature sensors on the engine.
- g. Remove the high and pre-high coolant temperature sensing elements from the engine and temporarily seal their normal location on the engine and temporarily install temperature gauges in their normal locations on the engine (required for safety, not for recorded data). Where necessary provide temporary wiring harness to connect the sensing elements to their permanent electrical leads.
- h. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set at no load until the output voltage and frequency stabilize.
- i. Immerse the elements in a vessel containing controlled-temperature hot oil and record the temperature at which the pre-high alarm activates and the temperature at which the engine shuts down. Remove the temporary temperature gauges and reinstall the temperature sensors on the engine.

- j. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.
- k. Operate the engine generator-set for at least 30 minutes at 100 percent of service load.
- l. Verify proper operation of the governor and voltage regulator.
- m. Verify proper operation and setpoints of gauges and instruments.
- n. Verify proper operation of ancillary equipment.
- o. Manually adjust the governor to increase engine speed past the overspeed limit. Record the RPM at which the engine shuts down.
- p. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 75 percent of rated load.
- q. Manually fill the tank to a level above the overfill limit. Record the level at which the overfill alarm sounds. Drain the tank down below the overfill limit.
- r. Shut down the engine. Remove the time-delay low lube oil pressure alarm bypass and try to start the engine. Record the results.
- s. Attach a manifold to the engine oil system (at the oil sensor pressure port) that contains a shutoff valve in series with a connection for the engine's oil pressure sensor followed by an oil pressure gauge ending with a bleed valve. The engine's oil pressure sensor shall be moved from the engine to the manifold and its normal location on the engine temporarily sealed. The manifold shutoff valve shall be open and bleed valve closed.
- t. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 75 percent of service load.
- u. Close the manifold shutoff valve. Slowly allow the pressure in the manifold to bleed off through the bleed valve while watching the pressure gauge. Record the pressure at which the engine shuts down. Catch oil spillage from the bleed valve in a container. Add the oil from the container back to the engine, remove the manifold, and reinstall the engine's oil pressure sensor on the engine.
- v. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 100% of service load. Record the maximum sound level in each frequency band at a distance of 75 feet from the end of the exhaust and air intake piping directly along the path of intake and discharge horizontal piping; or at a radius of 75 feet from the engine at 45 degrees apart in all directions for vertical piping. The measurements should comply with the paragraph SOUND LIMITATIONS. If a sound limiting enclosure is not provided, the muffler and air

intake silencer shall be modified or replaced as required to meet the sound limitations of this specification. If the sound limitations can not be obtained by modifying or replacing the muffler and air intake silencer, the contractor shall notify the Contracting Officer and provide a recommendation for meeting the sound limitations.

- w. Manually drain off fuel slowly from the tank to empty it to below the low fuel level limit and record the level at which the audible alarm sounds. Add fuel back to the tank to fill it above low level alarm limits.

3.4.5 Performance Tests

3.4.5.1 Continuous Engine Load Run Test

The engine-generator set and ancillary systems shall be tested at service load to: demonstrate durability; verify that heat of extended operation does not adversely affect or cause failure in any part of the system; and check all parts of the system. If the engine load run test is interrupted for any reason, the entire test shall be repeated. The engine load run test shall be accomplished principally during daylight hours, with an average ambient temperature of 100 degrees F., during the month of July. After each change in load in the following test, measure the vibration at the end bearings (front and back of engine, outboard end of generator) in the horizontal, vertical, and axial directions. Verify that the vibration is within the allowable range. Measurements are to be recorded after stabilization of an engine-generator set parameter (voltage, frequency, current, temperature, etc.). Stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings. Data taken at 15 minutes intervals shall include the following:

- a. Electrical: Output amperes, voltage, real and reactive power, power factor, frequency.

- b. Pressure: Lube-oil.

- c. Temperature: Coolant.
Lube-oil.
Ambient.

- (1) Perform and record engine manufacturer's recommended prestarting checks and inspections. Include as a minimum checking of coolant fluid, fuel, and lube-oil levels.

- (2) Start the engine; make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.

- (3) Operate the engine generator-set for at least 2 hours at 75 percent of service load.

- (4) Increase load to 100% of service load and operate the engine generator-set for at least 2 hours.

- (5) Remove load from the engine-generator set.

3.4.5.2 Load Acceptance Test

Engine manufacturer's recommended prestarting checks and inspections shall be performed and recorded. The engine shall be started, and engine manufacturer's after-starting checks and inspections made and recorded during a reasonable warm-up period. For the following steps, the output line-line and line-neutral voltages and frequency shall be recorded after performing each step instruction (after stabilization of voltage and frequency). Stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings.

- a. Apply load in steps no larger than the Maximum Step Load Increase to load the engine-generator set to 100 of Service Load.
- b. Verify that the engine-generator set responds to the load addition and that the output voltage returns to and stabilizes within the rated bandwidths.

3.5 FINAL INSPECTION AND TESTING

- a. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.
- b. Increase the load in steps no greater than the maximum step load increase to 100% of service load, and operate the engine-generator set for at least 30 minutes. Measure the vibration at the end bearings (front and back of engine, outboard end of generator) in the horizontal, vertical, and axial directions. Verify that the vibration is within the same range as previous measurements and is within the required range.
- c. Remove load and shut down the engine-generator set after the recommended cool down period. Perform the pre-test inspections and take necessary corrective actions.
- d. Remove the lube oil filter and have the oil and filter examined by the engine manufacturer for excessive metal, abrasive foreign particles, etc. Any corrective action shall be verified for effectiveness by running the engine for 4 hours at service load, then re-examining the oil and filter.
- e. Remove the fuel filter and examine the filter for trash, abrasive foreign particles, etc.
- f. Visually inspect and check engine and generator mounting bolts for tightness and visible damage.
- g. Replace air, oil, and fuel filters with new filters.

3.6 MANUFACTURER'S FIELD SERVICE

3.6.1 Onsite Training

The Contractor shall conduct training course for operating staff as designated by the Contracting Officer. The training period shall consist of a total 4 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance. The course

instructions shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations such as oil change, oil filter change, and air filter change.

3.6.2 Manufacturer's Representative

The engine generator-set manufacturer shall furnish a qualified representative to supervise the installation of the engine generator-set, assist in the performance of the onsite tests, and instruct personnel as to the operational and maintenance features of the equipment.

3.7 INSTRUCTIONS

Two sets of instructions shall be typed in (8 1/2 x 11 inches) format, laminated in weatherproof plastic, and placed in three-ring vinyl binders. The binders shall be placed as directed by the Contracting Officer. The instructions shall be in place prior to acceptance of the engine generator set installation. First set of instructions shall include a one-line diagram, wiring and control diagrams and a complete layout of the system. Second set of instructions shall include the condensed operating instructions describing manufacturer's pre-start checklist and precautions; startup procedures for test-mode, manual-start mode, and automatic-start mode (as applicable); running checks, procedures, and precautions; and shutdown procedures, checks, and precautions. Instructions shall include procedures for interrelated equipment (such as heat recovery systems, co-generation, load-shedding, and automatic transfer switches).

3.8 ACCEPTANCE

Final acceptance of the engine-generator set will not be given until the Contractor has successfully completed all tests and after all defects in installation material or operation have been corrected.

-- End of Section --

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SECTION 16375A

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.4	(1984; R 1996) Mechanical Demand Registers
ANSI C12.10	(1997) Electromechanical Watthour Meters
ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C29.1	(1988; R 1996) Electrical Power Insulators - Test Methods
ANSI C37.16	(2000) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
ANSI C37.46	(1981; R 1992) Power Fuses and Fuse Disconnecting Switches
ANSI C37.50	(1989; R 1995) Switchgear, Low-Voltage AC Power Circuit Breakers Used in Enclosures - Test Procedures
ANSI C37.72	(1987) Manually-Operated Dead-Front, Padmounted Switchgear with Load-Interrupting Switches and Separable Connectors for Alternating-Current Systems
ANSI C37.121	(1989; R 1995) Switchgear, Unit Substations Requirements
ANSI C57.12.13	(1982) Conformance Requirements for Liquid-Filled Transformers Used in Unit Installations, Including Unit Substations
ANSI C57.12.21	(1995) Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with High-Voltage Bushings; (High-Voltage, 34 500 Grd Y/19 920 Volts and Below;

	Low-Voltage, 240/120; 167 kVA and Smaller)
ANSI C57.12.26	(1993) Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVA and Smaller
ANSI C57.12.27	(1982) Conformance Requirements for Liquid-Filled Distribution Transformers Used in Pad-Mounted Installations, Including Unit Substations
ANSI C57.12.28	(1999) Switchgear and Transformers - Padmounted Equipment - Enclosure Integrity
ANSI C80.1	(1995) Rigid Steel Conduit - Zinc Coated
ANSI C119.1	(1986; R 1997) Sealed Insulated Underground Connector Systems Rated 600 Volts
ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction
ANSI O5.1	(1992) Specifications and Dimensions for Wood Poles

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994ael) Gray Iron Castings
ASTM A 48M	(1994ael) Gray Iron Castings (Metric)
ASTM A 123/A 123M	(2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2000) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B 3	(1995) Soft or Annealed Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM B 231/B 231M	(1999) Concentric-Lay-Stranded Aluminum 1350 Conductors
ASTM B 400	(1994) Compact Round Concentric-Lay-Stranded Aluminum 1350 Conductors
ASTM B 496	(1999) Compact Round Concentric-Lay-Stranded Copper Conductors
ASTM B 609/B 609M	(1999) Standard Specification for Aluminum

1350 Round Wire, Annealed and Intermediate
Temper, for Electrical Purposes

ASTM B 800 (2000) 8000 Series Aluminum Alloy Wire for
Electrical Purposes-Annealed and
Intermediate Temper

ASTM B 801 (1999) Concentric-Lay-Stranded Conductors
of 8000 Series Aluminum Alloy for
Subsequent Covering or Insulation

ASTM C 478 (1997) Precast Reinforced Concrete Manhole
Sections

ASTM C 478M (1997) Precast Reinforced Concrete Mahhole
Sections (Metric)

ASTM D 923 (1997) Sampling Electrical Insulating
Liquids

ASTM D 1654 (1992) Evaluation of Painted or Coated
Specimens Subjected to Corrosive
Environments

ASTM D 2472 (2000) Sulfur Hexafluoride

ASTM D 4059 (1996) Analysis of Polychlorinated
Biphenyls in Insulating Liquids by Gas
Chromatography

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5 (1994; CS5a-1995) Cross-linked
Polyethylene Insulated Shielded Power
Cables Rated 5 Through 46 kV

AEIC CS6 (1996) Ethylene Propylene Rubber Insulated
Shielded Power Cables Rated 5 Through 69 kV

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a (1998) Approval Guide Fire Protection

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (1997) National Electrical Safety Code

IEEE C37.1 (1994) IEEE Standard Definition,
Specification, and Analysis of Systems
Used for Supervisory Control, Data
Acquisition, and Automatic Control

IEEE C37.2 (1996) Electrical Power System Device
Function Numbers and Contact Designations

IEEE C37.13 (1990; R 1995) Low-Voltage AC Power
Circuit Breakers Used in Enclosures

IEEE C37.20.1	(1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
IEEE C37.20.2	(1993; C37.20.2b) Metal-Clad and Station-Type Cubicle Switchgear
IEEE C37.20.3	(1997) Metal-Enclosed Interrupter Switchgear
IEEE C37.23	(1987; R 1991) Guide for Metal-Enclosed Bus and Calculating Losses in Isolated-Phase Bus
IEEE C37.30	(1997) Requirements for High-Voltage Switches
IEEE C37.34	(1994) Test Code for High-Voltage Air Switches
IEEE C37.41	(1994; C37.41c) Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories
IEEE C37.63	(1997) Requirements for Overhead, Pad-Mounted, Dry-Vault, and Submersible Automatic Line Sectionalizer for AC Systems
IEEE C37.90	(1989; R 1994) Relays and Relay Systems Associated with Electric Power Apparatus
IEEE C37.90.1	(1989; R 1994) IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems
IEEE C37.98	(1987; R 1991) Seismic Testing of Relays
IEEE C57.12.00	(1993) IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.13	(1993) Instrument Transformers
IEEE C57.98	(1993) Guide for Transformer Impulse Tests
IEEE C62.1	(1989; R 1994) Surge Arresters for AC Power Circuits
IEEE C62.2	(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems
IEEE C62.11	(1999) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits
IEEE Std 48	(1998) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV

IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 100	(1997) IEEE Standard Dictionary of Electrical and Electronics Terms
IEEE Std 242	(1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE Std 386	(1995) Separable Insulated Connector Systems for Power Distribution Systems Above 600V
IEEE Std 399	(1997) Recommended Practice for Industrial and Commercial Power Systems Analysis
IEEE Std 404	(1993) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V through 138 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V
IEEE Std 592	(1990; R 1996) Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA BU 1	(1994) Busways
NEMA FB 1	(1993) Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
NEMA FU 1	(1986) Low Voltage Cartridge Fuses
NEMA LA 1	(1992) Surge Arresters
NEMA PB 1	(1990) Panelboards
NEMA PB 2	(1995) Deadfront Distribution Switchboards
NEMA SG 2	(1993) High Voltage Fuses
NEMA SG 3	(1995) Power Switching Equipment
NEMA SG 5	(1995) Power Switchgear Assemblies
NEMA TC 5	(1990) Corrugated Polyolefin Coilable Plastic Utilities Duct
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation

NEMA TC 7 (1990) Smooth-Wall Coilable Polyethylene
Electrical Plastic Duct

NEMA WC 7 (1988; Rev 3 1996)
Cross-Linked-Thermosetting-Polyethylene-
Insulated Wire and Cable for the
Transmission and Distribution of
Electrical Energy

NEMA WC 8 (1988; Rev 3; 1996)
Ethylene-Propylene-Rubber-Insulated Wire
and Cable for the Transmission and
Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6 (1997) Rigid Metal Conduit

UL 198C (1986; Rev thru Feb 1998)
High-Interrupting-Capacity Fuses,
Current-Limiting Types

UL 198D (1995) Class K Fuses

UL 198E (1988; Rev Jul 1988) Class R Fuses

UL 198H (1988; Rev thru Nov 1993) Class T Fuses

UL 467 (1993; Rev thru Apr 1999) Grounding and
Bonding Equipment

UL 486A (1997; Rev thru Dec 1998) Wire Connectors
and Soldering Lugs for Use with Copper
Conductors

UL 486B (1997; Rev Jun 1997) Wire Connectors for
Use with Aluminum Conductors

UL 489 (1996; Rev thru Dec 1998) Molded-Case
Circuit Breakers, Molded-Case Switches,
and Circuit-Breaker Enclosures

UL 510 (1994; Rev thru Apr 1998) Polyvinyl
Chloride, Polyethylene and Rubber
Insulating Tape

UL 514A (1996; Rev Dec 1999) Metallic Outlet Boxes

UL 651 (1995; Rev thru Oct 1998) Schedule 40 and
80 Rigid PVC Conduit

UL 854 (1996; Rev Oct 1999) Service-Entrance
Cables

UL 857	(1994; Rev thru Dec 1999) Busways and Associated Fittings
UL 1072	(1995; Rev Mar 1998) Medium Voltage Power Cable
UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit
UL 1684	(2000) Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.2.2 Service Conditions

Items provided under this section shall be specifically suitable for the following service conditions. Seismic details shall conform to Section 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Electrical Distribution System;

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams manufacturers standard installation drawings and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be included with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall consist of the following:

a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. All optional items shall be clearly identified as included or excluded.

b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

As-Built Drawings;

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall provide three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction.

The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within 10 calendar days from the time the drawings are returned to the Contractor.

SD-03 Product Data

Nameplates;

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material and Equipment;

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

General Installation Requirements;

Procedures for cable pulling, diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

SD-06 Test Reports

Factory Tests;

Certified factory test reports shall be submitted when the manufacturer performs routine factory tests, including tests required by standards listed in paragraph REFERENCES. Results of factory tests performed shall be certified by the manufacturer, or an approved testing laboratory, and submitted within 7 days following successful completion of the tests. The manufacturer's pass-fail criteria for tests specified in paragraph FIELD TESTING shall be included.

Field Testing;

A proposed field test plan, 20 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Operating Tests;

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The condition specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

Cable Installation;

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

- a. Site layout drawing with cable pulls numerically identified.
- b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.
- c. The cable manufacturer and type of cable.
- d. The dates of cable pulls, time of day, and ambient temperature.
- e. The length of cable pull and calculated cable pulling

tensions.

f. The actual cable pulling tensions encountered during pull.

SD-07 Certificates

Material and Equipment;

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements.

The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

Cable Joints;

A certification that contains the names and the qualifications of people recommended to perform the splicing and termination of cables approved for installation under this contract. The certification shall indicate that any person recommended to perform actual splicing and terminations has been adequately trained in the proper techniques and have had at least three recent years of experience in splicing and terminating the same or similar types of cables approved for installation. In addition, any person recommended by the Contractor may be required to perform a practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of cables. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.

Cable Installer Qualifications;

The Contractor shall provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. A resume shall be provided showing the cable installers' experience in the last three years, including a list of references complete with

points of contact, addresses and telephone numbers.

SD-10 Operation and Maintenance Data

Electrical Distribution System;

Six copies of operation and maintenance manuals, within 7 calendar days following the completion of tests and including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

Three additional copies of the instructions manual shall be provided within 30 calendar days following the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Metal poles shall be handled and stored in accordance with the manufacturer's instructions.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the contracting officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 NAMEPLATES

2.2.1 General

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal. Equipment containing liquid dielectrics shall have the type of dielectric on the nameplate. Sectionalizer switch nameplates shall have a schematic with all switch positions shown and labeled. As a minimum, nameplates shall be provided for transformers, circuit breakers, meters, switches, and switchgear.

2.3 CORROSION PROTECTION

2.3.1 Aluminum Materials

Aluminum shall not be used.

2.3.2 Ferrous Metal Materials

2.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

2.3.2.2 Equipment

Equipment and component items, including but not limited to ferrous metal luminaries not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.4 CABLES

Cables shall be single conductor type unless otherwise indicated.

2.4.1 Low-Voltage Cables

Cables shall be rated 600 volts and shall conform to the requirements of NFPA 70, and must be UL listed for the application or meet the applicable section of either ICEA or NEMA standards.

2.4.1.1 Conductor Material

Underground cables shall be annealed copper complying with ASTM B 3 and ASTM B 8

2.4.1.2 Insulation

Insulation must be in accordance with NFPA 70, and must be UL listed for the application or meet the applicable sections of either ICEA, or NEMA standards.

2.4.1.3 Jackets

Multiconductor cables shall have an overall PVC outer jacket.

2.4.1.4 Direct Buried

Single and multi-conductor cables shall be of a type identified for direct burial. Service entrance cables shall conform to UL 854 for Type USE service entrance cable.

2.4.1.5 In Duct

Cables shall be single-conductor cable, in accordance with NFPA 70.

2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS

2.5.1 Low-Voltage Cable Splices

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A and UL 486B.

Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

2.6 CONDUIT AND DUCTS

Ducts shall be single, round-bore type, with wall thickness and fittings suitable for the application. Duct lines shall be concrete-encased, thin-wall type. Duct lines shall be nonencased direct-burial, thick-wall type.

2.6.1 Metallic Conduit

Intermediate metal conduit shall comply with UL 1242. Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

2.6.2 Nonmetallic Ducts

2.6.2.1 Concrete Encased Ducts

UL 651 Schedule 40 or NEMA TC 6 Type EB.

2.6.2.2 Direct Burial

UL 651 Schedule 80, or NEMA TC 6 Type DB.

2.6.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when

exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

2.7 MANHOLES, HANDHOLES, AND PULLBOXES

Manholes, handholes, and pullboxes shall be as indicated. Strength of manholes, handholes, and pullboxes and their frames and covers shall conform to the requirements of IEEE C2. Precast-concrete manholes shall have the required strength established by ASTM C 478, ASTM C 478M. Frames and covers shall be made of gray cast iron and a machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48, Class 30B, minimum. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be fabricated from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least 10,000 psi and a flexural strength of at least 5,000 psi. Pullbox and handhole covers in sidewalks, and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

2.8 GROUNDING AND BONDING

2.8.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 not less than 5/8 inch in diameter by 8 feet in length. Sectional type rods may be used.

2.8.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.9 CONCRETE AND REINFORCEMENT

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03307 Concrete For Minor Structures.

2.10 LIQUID DIELECTRICS

Liquid dielectrics for capacitors, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral-oil or less-flammable liquid as specified. Nonflammable fluids shall not be used.

Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than 50 parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 923 and have tests performed per ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 50 ppm shall be replaced.

2.11 FACTORY TESTS

Factory tests shall be performed, as follows, in accordance with the applicable publications and with other requirements of these specifications. The Contracting Officer shall be notified at least 10 days before the equipment is ready for testing. The Contracting Officer reserves the right to witness the tests.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03307 Concrete For Minor Structures.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

3.1.3 Disposal of Liquid Dielectrics

PCB-contaminated dielectrics must be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor shall furnish certification of proper disposal. Contaminated dielectrics shall not be diluted to lower the contamination level.

3.2 CABLE INSTALLATION

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, etc.

3.2.1 Cable Installation Plan and Procedure

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

3.2.1.1 Cable Inspection

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

3.2.1.2 Duct Cleaning

Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is 1/4 inch less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of 2 times or until less than a volume of 8 cubic inches of debris is expelled from the duct.

3.2.1.3 Duct Lubrication

The cable lubricant shall be compatible with the cable jacket for cable that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

3.2.1.4 Cable Installation

The Contractor shall provide a cable feeding truck and a cable pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manilla rope followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct. For cable installation in cold weather, cables shall be kept at 50 degrees F temperature for at least 24 hours before installation.

3.2.1.5 Cable Installation Plan

The Contractor shall submit a cable installation plan for all cable pulls in accordance with the detail drawings portion of paragraph SUBMITTALS. Cable installation plan shall include:

- a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.
- b. List of cable installation equipment.
- c. Lubricant manufacturer's application instructions.
- d. Procedure for resealing cable ends to prevent moisture from entering cable.
- e. Cable pulling tension calculations of all cable pulls.
- f. Cable percentage conduit fill.
- g. Cable sidewall thrust pressure.
- h. Cable minimum bend radius and minimum diameter of pulling wheels used.
- i. Cable jam ratio.

- j. Maximum allowable pulling tension on each different type and size of conductor.
- k. Maximum allowable pulling tension on pulling device.

3.2.2 Duct Line

Low-voltage cables shall be installed in duct lines where indicated. Cable splices in low-voltage cables shall be made in manholes and handholes only, except as otherwise noted. Neutral and grounding conductors shall be installed in the same duct with their associated phase conductors.

3.2.3 Electric Manholes

Cables shall be routed around the interior walls and securely supported from walls on cables racks. Cable routing shall minimize cable crossover, provide access space for maintenance and installation of additional cables, and maintain cable separation in accordance with IEEE C2.

3.3 DUCT LINES

3.3.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in manholes or handholes.

3.3.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.3.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with NFPA 70, except that electrical duct bank configurations for ducts 6 inches in diameter shall be determined by calculation and as shown on the drawings. The separation between adjacent electric power and communication ducts shall conform to IEEE C2. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement

shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point, except railroad and airfield crossings, tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70. At railroad and airfield crossings, duct lines shall be encased with concrete and reinforced as indicated to withstand specified surface loadings. Tops of concrete encasements shall be not less than 5 feet below tops of rails or airfield paving unless otherwise indicated. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.

3.3.4 Nonencased Direct-Burial

Top of duct lines shall be 24 inches below finished grade and shall be installed with a minimum of 3 inches of earth around each duct, except that between adjacent electric power and communication ducts, 12 inches of earth is required. Bottoms of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least 6 inches. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers. Duct banks may be held in alignment with earth. However, high-tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

3.3.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

3.3.5.1 Bituminized-Fiber Ducts

Bituminized-fiber ducts shall be used to interface with existing bituminized-fiber duct as shown. To ensure a watertight joint, tapered ends or joints of the same material as the ducts shall be swabbed with bituminous or joint-sealing compound before couplings are applied. Plastic or nonmetallic couplings shall be tightly driven onto unswabbed ducts. Due to the brittleness of plastic couplings at low temperatures, such couplings shall not be installed when temperatures are below 0 degrees F. Couplings shall be warmed in hot water or by another approved method when installed at temperatures below 32 degrees F.

3.3.5.2 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and

fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

3.4 MANHOLES, HANDHOLES, AND PULLBOXES

3.4.1 General

Manholes shall be constructed approximately where shown. The exact location of each manhole shall be determined after careful consideration has been given to the location of other utilities, grading, and paving. The location of each manhole shall be approved by the Contracting Officer before construction of the manhole is started. Manholes shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. The Contractor may at his option utilize monolithically constructed precast-concrete manholes having the required strength and inside dimensions as required by the drawings or specifications. In paved areas, frames and covers for manhole and handhole entrances in vehicular traffic areas shall be flush with the finished surface of the paving. In unpaved areas, the top of manhole covers shall be approximately 1/2 inch above the finished grade. Where existing grades that are higher than finished grades are encountered, concrete assemblies designed for the purpose shall be installed to elevate temporarily the manhole cover to existing grade level. All duct lines entering manholes must be installed on compact soil or otherwise supported when entering a manhole to prevent shear stress on the duct at the point of entrance to the manhole. Duct lines entering cast-in-place concrete manholes shall be cast in-place with the manhole. Duct lines entering precast concrete manholes through a precast knockout penetration shall be grouted tight with a portland cement mortar. PVC duct lines entering precast manholes through a PVC endbell shall be solvent welded to the endbell. A cast metal grille-type sump frame and cover shall be installed over the manhole sump. A cable-pulling iron shall be installed in the wall opposite each duct line entrance.

3.4.2 Electric Manholes

Cables shall be securely supported from walls by hot-dip galvanized cable racks with a plastic coating over the galvanizing and equipped with adjustable hooks and insulators. The number of cable racks indicated shall be installed in each manhole and not less than 2 spare hooks shall be installed on each cable rack. Insulators shall be made of high-glazed porcelain. Insulators will not be required on spare hooks.

3.4.3 Communications Manholes

The number of hot-dip galvanized cable racks with a plastic coating over the galvanizing indicated shall be installed in each telephone manhole. Each cable rack shall be provided with 2 cable hooks. Cables for the telephone and communication systems will be installed by others.

3.4.4 Handholes

Handholes shall be located approximately as shown. Handholes shall be of the type noted on the drawings and shall be constructed in accordance with the details shown.

3.4.5 Pullboxes

Pullbox tops shall be flush with sidewalks or curbs or placed 1/2 inch above surrounding grades when remote from curbed roadways or sidewalks. Covers shall be marked "Low-Voltage" and provided with 2 lifting eyes and 2 hold-down bolts. Each box shall have a suitable opening for a ground rod. Conduit, cable, ground rod entrances, and unused openings shall be sealed with mortar.

3.4.6 Ground Rods

A ground rod shall be installed at the manholes, handholes and pullboxes. Ground rods shall be driven into the earth before the manhole floor is poured so that approximately 4 inches of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.

3.5 PAD-MOUNTED EQUIPMENT INSTALLATION

Pad-mounted equipment, shall be installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of this document. Units shall be installed so that they do not damage equipment or scratch painted or coated surfaces. After installation, surfaces shall be inspected and scratches touched up with a paint or coating provided by the manufacturer especially for this purpose.

3.5.1 Concrete Pads

3.5.1.1 Construction

Concrete pads for pad-mounted electrical equipment may be either pre-fabricated or poured-in-place. Pads shall be constructed as indicated, except that exact pad dimensions and mounting details are equipment specific and are the responsibility of the Contractor. Tops of concrete pads shall be level and shall project 4 inches above finished paving or grade and sloped to drain. Edges of concrete pads shall have 3/4 inch chamfer. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placement of concrete pads. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. To facilitate cable installation and termination, the concrete pad shall be provided with a rectangular hole below the primary and secondary compartments, sized in accordance with the manufacturer's recommended dimensions. Upon completion of equipment installation the rectangular hole shall be filled with masonry grout.

3.5.1.2 Concrete and Reinforcement

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03307 Concrete For Minor Structures.

3.5.1.3 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.6 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated, and shall be connected to the first applicable termination point in each building. Interfacing with building interior conduit systems shall be at conduit stubouts terminating 5 feet outside of a building and 2 feet below finished grade as specified and provided under Section 16415 ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed with caulking compound to prevent entrance of moisture or gases into buildings.

3.7 GROUNDING

A ground consisting of the indicated configuration of bare copper conductors and driven ground rods shall be installed around pad-mounted equipment. Equipment frames of metal-enclosed equipment, and other noncurrent-carrying metal parts, such as cable shields, and metallic conduit shall be grounded. Metallic frames and covers of handholes and pull boxes shall be grounded by use of a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.7.1 Grounding Electrodes

Grounding electrodes shall be installed as follows:

- a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade.
- d. Additional electrodes - When the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors to achieve the specified ground resistance. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

3.7.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.7.3 Grounding and Bonding Conductors

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.7.4 Manhole, Handhole, or Concrete Pullbox Grounding

Ground rods installed in manholes, handholes, or concrete pullboxes shall be connected to cable racks, cable-pulling irons, the cable shielding, metallic sheath, and armor at each cable joint or splice by means of a No. 4 AWG braided tinned copper wire. Connections to metallic cable sheaths shall be by means of tinned terminals soldered to ground wires and to cable sheaths. Care shall be taken in soldering not to damage metallic cable sheaths or shields. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations. Grounding electrode conductors shall be neatly and firmly attached to manhole or handhole walls and the amount of exposed bare wire shall be held to a minimum.

3.8 FIELD TESTING

3.8.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 7 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field test reports shall be signed and dated by the Contractor.

3.8.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.8.3 Ground-Resistance Tests

The resistance of each grounding electrode shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.

3.8.4 Low-Voltage Cable Test

Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations of conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 1000 / (\text{length of cable in feet})$

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

3.8.5 Pre-Energization Services

Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of 2 years of current product experience. The following services shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to ensure that installation is in compliance with the recommendations of the manufacturer. Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage caused during installation or shipment to ensure packaging materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and tested in accordance with the instructions of the equipment manufacturer. Items for which such services shall be provided, but are not limited to, are the following:

- a. Panelboards
- b. Switchboards
- c. Switches

3.8.6 Operating Tests

After the installation is completed, and at such times as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.9 MANUFACTURER'S FIELD SERVICE

3.9.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, and servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHS format video tape of the entire training session shall be submitted.

3.9.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of the equipment, assist in the performance of the onsite tests, initial operation, and instruct personnel as to the operational and maintenance features of the equipment.

3.10 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

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SECTION 16410A

AUTOMATIC TRANSFER SWITCH

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117 (1997) Operating Salt Spray (Fog) Apparatus

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.13 (1990; R 1995) Low-Voltage AC Power Circuit Breakers Used in Enclosures

IEEE C37.90.1 (1989; R 1994) IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems

IEEE C62.41 (1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits

IEEE Std 602 (1996) Electric Systems in Health Care Facilities

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1 (1993) Industrial Controls and Systems

NEMA ICS 2 (1993) Industrial Controls and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC

NEMA ICS 4 (1997) Industrial Control and Systems Terminal Blocks

NEMA ICS 6 (1993) Industrial Control and Systems, Enclosures

NEMA ICS 10 (1999) Industrial Control and Systems: AC Transfer Switch Equipment - Part 2: Static AC Transfer Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NFPA 110 (1999) Emergency and Standby Power Systems

UNDERWRITERS LABORATORIES (UL)

UL 1008	(1996; Rev thru Feb 1999) Transfer Switch Equipment
UL 1066	(1997) Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Switches;

Schematic, external connection, one-line schematic and wiring diagram of each ATS assembly. Interface equipment connection diagram showing conduit and wiring between ATS and related equipment. Device, nameplate, and item numbers shown in list of equipment and material shall appear on drawings wherever that item appears. Diagrams shall show interlocking provisions and cautionary notes, if any. Operating instructions shall be shown either on one-line diagram or separately. Unless otherwise approved, one-line and elementary or schematic diagrams shall appear on same drawing.

Equipment;
Installation;

Dimensioned plans, sections and elevations showing minimum clearances, weights, and conduit entry provisions for each ATS.

SD-03 Product Data

Material;
Equipment;

List of proposed equipment and material, containing a description of each separate item.

SD-06 Test Reports

Testing; G, RE

A description of proposed field test procedures, including proposed date and steps describing each test, its duration and expected results, not less than 2 weeks prior to test date.

Certified factory and field test reports, within 14 days following completion of tests. Reports shall be certified and dated and shall demonstrate that tests were successfully completed prior to shipment of equipment.

SD-07 Certificates

Equipment;
Material;

Certificates of compliance showing evidence of UL listing and conformance with applicable NEMA standards. Such certificates are not required if manufacturer's published data, submitted and approved, reflect UL listing or conformance with applicable NEMA standards.

Switching Equipment;

Evidence that ATS withstand current rating (WCR) has been coordinated with upstream protective devices as required by UL 1008. Upon request, manufacturer shall also provide notarized letter certifying compliance with requirements of this specification, including withstand current rating.

SD-10 Operation and Maintenance Data

Switching Equipment;
Instructions;

Six copies of operating manual outlining step-by-step procedures for system startup, operation, and shutdown. Manual shall include manufacturer's name, model number, service manual, parts list, and brief description of equipment and basic operating features. Manufacturer's spare parts data shall be included with supply source and current cost of recommended spare parts. Six copies of maintenance manual listing routine maintenance, possible breakdowns, repairs, and troubleshooting guide. Manual shall include simplified wiring and control diagrams for system as installed.

1.3 GENERAL REQUIREMENTS

1.3.1 Standard Product

Material and equipment shall be standard products of a manufacturer regularly engaged in manufacturing the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. The experience use shall include applications in similar circumstances and of same design and rating as specified ATS. Equipment shall be capable of being serviced by a manufacturer-authorized and trained organization that is, in the Contracting Officer's opinion, reasonably convenient to the site.

1.3.2 Nameplate

Nameplate showing manufacturer's name and equipment ratings shall be made of corrosion-resistant material with not less than 1/8 inch tall characters. Nameplate shall be mounted to front of enclosure and shall comply with nameplate requirements of NEMA ICS 2.

1.4 SERVICE CONDITIONS

Seismic requirements shall be as specified in Section 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

PART 2 PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH (ATS)

ATS shall be electrically operated and mechanically held in both operating positions. ATS shall be suitable for use in emergency systems described in NFPA 70. ATS shall be UL listed. ATS shall be manufactured and tested in accordance with applicable requirements of IEEE C37.90.1, IEEE C37.13, IEEE C62.41, IEEE Std 602, NEMA ICS 1, NEMA ICS 2, NEMA ICS 10, UL 1008 and UL 1066. ATS shall conform to NFPA 110. To facilitate maintenance, manufacturer's instruction manual shall provide typical maximum contact voltage drop readings under specified conditions for use during periodic maintenance. Manufacturer shall provide instructions for determination of contact integrity. ATS shall be rated for continuous duty at specified continuous current rating. ATS shall have following characteristics:

- a. Voltage: 120/240 volts ac.
- b. Number of Phases: One.
- c. Number of Wires: Three.
- d. Frequency: 60 Hz.
- e. Poles: Two switched and solid neutral.
- f. ATS WCR: Rated to withstand short-circuit current of 30,000 amperes, RMS symmetrical.
- g. Nonwelding Contacts: Rated for nonwelding of contacts when used with upstream feeder overcurrent devices shown and with available fault current specified.
- h. Main Contacts: Contacts shall have silver alloy composition.

2.1.1 Override Time Delay

Time delay to override monitored source deviation shall be adjustable from 0.5 to 6 seconds and factory set at 1 second. ATS shall monitor phase conductors to detect and respond to sustained voltage drop of 25 percent of nominal between any two normal source conductors and initiate transfer action to alternate source and start engine driven generator after set time period. Pickup voltage shall be adjustable from 85 to 100 percent of nominal and factory set at 90 percent. Dropout voltage shall be adjustable from 75 to 98 percent of pickup value and factory set at 85 percent of nominal.

2.1.2 Transfer Time Delay

Time delay before transfer to alternate power source shall be adjustable from 0 to 5 minutes and factory set at 0 minute. ATS shall monitor frequency and voltage of alternate power source and transfer when frequency and voltage are stabilized. Pickup voltage shall be adjustable from 85 to 100 percent of nominal and factory set at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal and factory set at 90 percent.

2.1.3 Return Time Delay

Time delay before return transfer to normal power source shall be adjustable from 0 to 30 minutes and factory set at 15 minutes. Time delay shall be automatically defeated upon loss or sustained undervoltage of alternate power source, provided that normal supply has been restored.

2.1.4 Engine Shutdown Time Delay

Time delay shall be adjustable from 0 to 30 minutes and shall be factory set at 10 minutes.

2.1.5 Supplemental Features

ATS shall be furnished with the following:

- a. Engine start contact.
- b. Alternate source monitor.
- c. Test switch to simulate normal power outage.
- d. Voltage sensing. Pickup voltage adjustable from 85 to 100 percent of nominal; dropout adjustable from 75 to 98 percent of pickup.
- e. Time delay bypass switch to override return time delay to normal.
- f. Manual return-to-normal switch.
- g. Means shall be provided in the ATS to insure that motor/transformer load inrush currents do not exceed normal starting currents. This shall be accomplished with either in-phase monitoring, time-delay transition, or load voltage decay sensing methods. If manufacturer supplies an in-phase monitoring system, the manufacturer shall indicate under what conditions a transfer cannot be accomplished. If the manufacturer supplies a time-delay transition system, the manufacturer shall supply recommendations for establishing time delay. If load voltage decay sensing is supplied, the load voltage setting shall be user programmable.

2.1.6 Operator

Manual operator conforming to UL 1008 shall be provided, and shall incorporate features to prevent operation by unauthorized personnel. ATS shall be designed for safe manual operation under full load conditions. If manual operation is accomplished by opening the door, then a dead-front shall be supplied for operator safety.

2.1.7 Green Indicating Light

A green indicating light shall supervise/provide normal power source switch position indication and shall have a nameplate engraved NORMAL.

2.1.8 Red Indicating Light

A red indicating light shall supervise/provide alternate power source switch position indication and shall have a nameplate engraved ALTERNATE.

2.2 ENCLOSURE

ATS and accessories shall be installed in free-standing, floor-mounted, unventilated NEMA ICS 6, Type 3R, smooth sheet metal enclosure constructed in accordance with applicable requirements of UL 1066 and/or UL 1008. Metal gauge shall be not less than No. 14. Enclosure shall be equipped with at least two approved grounding lugs for grounding enclosure to facility ground system using No. 4 AWG copper conductors. Factory wiring within enclosure and field wiring terminating within enclosure shall comply with NFPA 70. If wiring is not color coded, wire shall be permanently tagged or marked near terminal at each end with wire number shown on approved detail drawing. Terminal block shall conform to NEMA ICS 4. Terminals shall be arranged for entrance of external conductors from bottom of enclosure. Main switch terminals, including neutral terminal if used, shall be pressure type suitable for termination of external copper conductors.

2.2.1 Construction

Enclosure shall be constructed for ease of removal and replacement of ATS components and control devices from front without disconnection of external power conductors or removal or disassembly of major components.

2.2.2 Cleaning and Painting

Both the inside and outside surfaces of an enclosure, including means for fastening, shall be protected against corrosion by enameling, galvanizing, plating, powder coating, or other equivalent means. Protection is not required for metal parts that are inherently resistant to corrosion, bearings, sliding surfaces of hinges, or other parts where such protection is impractical. Finish shall be manufacturer's standard material, process, and color and shall be free from runs, sags, peeling, or other defects. An enclosure marked Type 3R shall be acceptable if there is no visible rust at the conclusion of a salt spray (fog) test using the test method in ASTM B 117, employing a 5 percent by weight, salt solution for 24 hours. Type 4X enclosures are acceptable following performance of the above test with an exposure time of 200 hours.

2.3 TESTING

2.3.1 Factory Testing

A prototype of specified ATS shall be factory tested in accordance with UL 1008. In addition, factory tests shall be performed on each ATS as follows:

- a. Insulation resistance test to ensure integrity and continuity of entire system.
- b. Main switch contact resistance test.
- c. Visual inspection to verify that each ATS is as specified.
- d. Mechanical test to verify that ATS sections are free of mechanical hindrances.
- e. Electrical tests to verify complete system electrical operation and to set up time delays and voltage sensing settings.

2.3.2 Factory Test Reports

Manufacturer shall provide three certified copies of factory test reports.

PART 3 EXECUTION

3.1 INSTALLATION

ATS shall be installed in accordance with approved manufacturer's instructions.

3.2 INSTRUCTIONS

Manufacturer's approved operating instructions shall be permanently secured to cabinet where operator can see them. One-line and elementary or schematic diagram shall be permanently secured to inside of front enclosure door.

3.3 SITE TESTING

Following completion of ATS installation and after making proper adjustments and settings, site tests shall be performed in accordance with manufacturer's written instructions to demonstrate that each ATS functions satisfactorily and as specified. Contractor shall advise Contracting Officer not less than 5 working days prior to scheduled date for site testing, and shall provide certified field test reports within 2 calendar weeks following successful completion of site tests. Test reports shall describe adjustments and settings made and site tests performed. Minimum operational tests shall include the following:

- a. Insulation resistance shall be tested, both phase-to-phase and phase-to-ground.
- b. Power failure of normal source shall be simulated by opening upstream protective device. This test shall be performed a minimum of five times.
- c. Power failure of emergency source with normal source available shall be simulated by opening upstream protective device for emergency source. This test shall be performed a minimum of five times.
- d. Low phase-to-ground voltage shall be simulated for each phase of normal source.
- e. Operation and settings shall be verified for specified ATS features, such as override time delay, transfer time delay, return time delay, engine shutdown time delay, exerciser, auxiliary contacts, and supplemental features.
- f. Manual and automatic ATS functions shall be verified.

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SECTION 16415A

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ELECTRICAL WORK, INTERIOR

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(1995) Code for Electricity Metering
ANSI C12.4	(1984; R 1996) Mechanical Demand Registers
ANSI C12.10	(1997) Electromechanical Watthour Meters
ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL Through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C37.16	(1997) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
ANSI C39.1	(1981; R 1992) Requirements for Electrical Analog Indicating Instruments
ANSI C57.12.10	(1988) Safety Requirements for Transformers 230 kV and Below 833/958 Through 8333/10417 kVA, Single-Phase, and 750/862 Through 60 000/80 000/100 000 kVA, Three-Phase Without Load Tap Charging; and 3750/4687 Through 60 000/80 000/100 000 kVA With Load Tap Charging
ANSI C57.12.13	(1982) Conformance Requirements for Liquid-Filled Transformers Used in Unit Installations, Including Unit Substations
ANSI C57.12.27	(1982) Conformance Requirements for Liquid-Filled Distribution Transformers Used in Pad-Mounted Installations, Including Unit Substations
ANSI C57.12.50	(1981; R 1989) Ventilated Dry-type Distribution Transformers 1 to 500 kVA, Single-Phase; and 15 to 500 kVA, Three-Phase with High-Voltage 601 to 34 500 Volts, Low-Voltage 120 to 600 Volts

ANSI C57.12.51	(1981; R 1989) Ventilated Dry-Type Power Transformers, 501 kVA and Larger, Three-Phase, with High-Voltage 601 to 34 500 Volts, Low-Voltage 208Y/120 to 4160 Volts
ANSI C57.12.52	(1981; R 1989) Sealed Dry-Type Power Transformers, 501 kVA and Larger, Three-Phase with High-Voltage 601 to 34 500 Volts, Low-Voltage 208Y/120 to 4160 Volts
ANSI C57.12.70	(1978; R 1993) Terminal Markings and Connections for Distribution and Power Transformers
ANSI C78.1	(1991; C78.1a; R 1996) Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics
ANSI C78.20	(1995) Electric Lamps - Characteristics of Incandescent Lamps A, G, PS, and Similar Shapes with E26 Medium Screw Bases
ANSI C78.21	(1995) Physical and Electrical Characteristics - Incandescent Lamps - PAR and R Shapes
ANSI C78.1350	(1990) 400-Watt, 100-Volt, S51 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1351	(1989) 250-Watt, 100-Volt S50 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1352	(1990) 1000-Watt, 250-Volt, S52 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1355	(1989) 150-Watt, 55-Volt S55 High-Pressure Sodium Lamps
ANSI C78.1375	(1996) 400-Watt, M59 Single-Ended Metal-Halide lamps
ANSI C78.1376	(1996) 1000-Watt, M47 Single-Ended Metal-Halide Lamps
ANSI C78.2A	(1991) 18 & 26- Watt, Compact Fluorescent Quad Tube Lamps
ANSI C78.2B	(1992) 9 & 13-Watt, Compact Fluorescent Quad Tube Lamps
ANSI C80.5	(1995) Rigid Aluminum Conduit
ANSI C82.1	(1997) Specifications for Fluorescent Lamp Ballasts
ANSI C82.4	(1992) Ballasts for High-Intensity-Discharge and Low-Pressure

Sodium Lamps (Multiple-Supply Type)

ANSI C135.30 (1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 1 (1995) Hard-Drawn Copper Wire

ASTM B 8 (1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM D 709 (1992; R 1997) Laminated Thermosetting Materials

ASTM D 4059 (1996) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 18 Industrial, Scientific, and Medical Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (1997) National Electrical Safety Code

IEEE C37.13 (1990; R 1995) Low-Voltage AC Power Circuit Breakers Used in Enclosures

IEEE C37.20.1 (1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear

IEEE C57.12.00 (1993) IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

IEEE C57.12.80 (1996) Terminology for Power and Distribution Transformers

IEEE C57.12.90 (1993) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers

IEEE C57.13 (1993) Instrument Transformers

IEEE C57.98 (1993) Guide for Transformer Impulse Tests

IEEE C57.100 (1986; R 1992) Test Procedure for Thermal Evaluation of Oil-Immersed Distribution Transformers

IEEE C62.41 (1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits

IEEE Std 81 (1983) Guide for Measuring Earth

Resistivity, Ground Impedance, and Earth
Surface Potentials of a Ground System
(Part 1)

IEEE Std 242 (1986; R 1991) Recommended Practice for
Protection and Coordination of Industrial
and Commercial Power Systems

IEEE Std 399 (1997) Recommended Practice for Industrial
and Commercial Power Systems Analysis

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment
(1000 Volts Maximum)

NEMA AB 1 (1993) Molded Case Circuit Breakers and
Molded Case Switches

NEMA BU 1 (1994) Busways

NEMA FU 1 (1986) Low Voltage Cartridge Fuses

NEMA ICS 1 (1993) Industrial Control and Systems

NEMA ICS 2 (1993) Industrial Control and Systems
Controllers, Contactors, and Overload
Relays Rated Not More Than 2,000 Volts AC
or 750 Volts DC

NEMA ICS 3 (1993) Industrial Control and Systems
Factory Built Assemblies

NEMA ICS 6 (1993) Industrial Control and Systems
Enclosures

NEMA LE 4 (1987) Recessed Luminaires, Ceiling
Compatibility

NEMA MG 1 (1993; Rev 1; Rev 2; Rev 3; Rev 4) Motors
and Generators

NEMA MG 10 (1994) Energy Management Guide for
Selection and Use of Polyphase Motors

NEMA OS 1 (1996) Sheet-Steel Outlet Boxes, Device
Boxes, Covers, and Box Supports

NEMA OS 2 (1986; Errata Aug 1986; R 1991)
Nonmetallic Outlet Boxes, Device Boxes,
Covers and Box Supports

NEMA PB 1 (1995) Panelboards

NEMA PB 2 (1995) Deadfront Distribution Switchboards

NEMA PE 5 (1996) Utility Type Battery Chargers

NEMA RN 1 (1989) Polyvinyl-Chloride (PVC) Externally

Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

NEMA SG 3	(1995) Power Switching Equipment
NEMA ST 20	(1992) Dry-Type Transformers for General Applications
NEMA TC 2	(1990) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA TC 13	(1993) Electrical Nonmetallic Tubing (ENT)
NEMA VE 1	(1996) Metal Cable Tray Systems
NEMA WD 1	(1983; R 1989) General Requirements for Wiring Devices
NEMA WD 6	(1988) Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
NFPA 101	(1997; Errata 97-1; TIA 97-1) Life Safety Code

UNDERWRITERS LABORATORIES (UL)

UL 1	(1993; Rev thru Jan 1995) Flexible Metal Conduit
UL 4	(1996) Armored Cable
UL 5	(1996) Surface Metal Raceways and Fittings
UL 6	(1997) Rigid Metal Conduit
UL 20	(1995; Rev thru Oct 1998) General-Use Snap Switches
UL 44	(1997; Rev Mar 1999) Thermoset-Insulated Wires and Cables
UL 50	(1995; Rev thru Oct 1997) Enclosures for Electrical Equipment
UL 67	(1993; Rev thru Nov 1995) Panelboards
UL 83	(1998) Thermoplastic-Insulated Wires and Cables
UL 98	(1994; R thru Jun 1998) Enclosed and Dead-Front Switches
UL 198B	(1995) Class H Fuses

UL 198C	(1986; Rev thru Feb 1998) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198D	(1995) Class K Fuses
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198G	(1988; Rev May 1988) Fuses for Supplementary Overcurrent Protection
UL 198H	(1988; Rev thru Nov 1993) Class T Fuses
UL 198L	(1995; Rev May 1995) D-C Fuses for Industrial Use
UL 360	(1996; Rev thru Oct 1997) Liquid-Tight Flexible Steel Conduit
UL 467	(1993; Rev thru Aug 1996) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru Dec 1998) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors
UL 486C	(1997; Rev thru Aug 1998) Splicing Wire Connectors
UL 486E	(1994; Rev thru Feb 1997) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
UL 489	(1996; Rev thru Dec 1998) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(1996; Rev thru Sep 1998) Attachment Plugs and Receptacles
UL 506	(1994; Rev Oct 1997) Specialty Transformers
UL 508	(1999) Industrial Control Equipment
UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 512	(1993; R Dec 1995) Fuseholders
UL 514A	(1996; Rev Jul 1998) Metallic Outlet Boxes
UL 514B	(1997; Rev Oct 1998) Fittings for Cable and Conduit
UL 514C	(1996; R Sep 1998) Nonmetallic Outlet

Boxes, Flush-Device Boxes, and Covers

UL 542	(1994; Rev thru Jul 1998) Lampholders, Starters, and Starter Holders for Fluorescent Lamps
UL 651	(1995; Rev thru Oct 1998) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(1995; Rev thru Apr 1998) Type EB and A Rigid PVC Conduit and HDPE Conduit
UL 674	(1994; Rev thru Oct 1998) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
UL 698	(1999)) Industrial Control Equipment for Use in Hazardous (Classified) Locations
UL 719	(1999) Nonmetallic-Sheathed Cables
UL 797	(1993; Rev thru Mar 1997) Electrical Metallic Tubing
UL 817	(1994; Rev thru Jul 1998) Cord Sets and Power-Supply Cords
UL 844	(1995; Rev thru Aug 1997) Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
UL 845	(1995; Rev Feb 1996) Motor Control Centers
UL 854	(1996; Rev Apr 1998) Service-Entrance Cables
UL 857	(1994; Rev thru May 1999) Busways and Associated Fittings
UL 869A	(1998) Reference Standard for Service Equipment
UL 877	(1993; Rev thru May 1997) Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous (Classified) Locations
UL 886	(1994; Rev thru Apr 1999) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
UL 891	(1994; Rev thru Jan 1995) Dead-Front Switchboards
UL 916	(1998) Energy Management Equipment
UL 924	(1995; Rev thru Oct 97) Emergency Lighting and Power Equipment
UL 935	(1995; Rev thru Oct 1998) Fluorescent-Lamp

Ballasts

UL 943	(1993; Rev thru May 1998) Ground-Fault Circuit-Interrupters
UL 1004	(1994; Rev thru Dec 1997) Electric Motors
UL 1010	(1995; Rev thru Dec 1996) Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations
UL 1022	(1998) Line Isolation Monitors
UL 1029	(1994; Rev thru Dec 1997) High-Intensity-Discharge Lamp Ballasts
UL 1047	(1995; Rev Jul 1998) Isolated Power Systems Equipment
UL 1236	(1994; Rev thru Dec 1997) Battery Chargers for Charging Engine-Starter Batteries
UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit
UL 1449	(1996; Rev thru Oct 1998) Transient Voltage Surge Suppressors
UL 1564	(1993; Rev Sep 1998) Industrial Battery Chargers
UL 1569	(1995; Rev thru Sep 1998) Metal-Clad Cables
UL 1570	(1995; Rev thru Jun 1997) Fluorescent Lighting Fixtures
UL 1571	(1995; Rev thru Jun 1997) Incandescent Lighting Fixtures
UL 1572	(1995; Rev thru Jun 1997) High Intensity Discharge Lighting Fixtures
UL 1660	(1994; Rev Apr 1998) Liquid-Tight Flexible Nonmetallic Conduit
UL Elec Const Dir	(1998) Electrical Construction Equipment Directory

1.2 GENERAL

1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated or shown.

1.2.2 Coordination

The preengineered buildings shall be provided with general location and arrangement of equipment, conduit, and wiring. The preengineered building

manufacturer shall provide the outlets and equipment be properly located and readily accessible. Lighting fixtures, outlets, and other equipment and materials shall be carefully coordinated with mechanical or structural features. See sheet E5.01 panel schedules. The Contractor shall coordinate the electrical requirements of the mechanical work and provide all power related circuits, wiring, hardware and structural support, for connection to the preengineered buildings.

1.2.3 Special Environments

1.2.3.1 Weatherproof Locations

Wiring, Fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

1.2.4 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.5 Nameplates

1.2.5.1 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The front of each panelboard, motor control center, switchgear, and switchboard shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 1/4 inch
High Letters

Minimum 1/8 inch
High Letters

Panelboards

Switchboards
Motors

Each panel, section, or similar assemblies shall be provided with a nameplate in addition to nameplates listed above, which shall be provided for individual compartments in the respective assembly, including nameplates which identify "future," "spare," and "dedicated" or "equipped spaces."

1.2.6 As-Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish 2 sets of as-built drawings to the Contracting Officer.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Interior Electrical Equipment; .

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams, and other information necessary to define the installation. Detail drawings shall show the rating of items and systems and how the components of an item and system are assembled, function together, and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission.

Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall show physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded.

Electrical drawings including single-line and three-line diagrams, and schematics or elementary diagrams of each electrical system; internal wiring and field connection diagrams of each electrical device when published by the manufacturer; wiring diagrams of cabinets, panels, units, or separate mountings; interconnection diagrams that show the wiring between separate components of assemblies; field connection diagrams that show the termination of wiring routed between separate items of equipment; internal wiring diagrams of equipment showing wiring as actually provided for this project. Field wiring connections shall be clearly identified.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons why, shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Manufacturer's Catalog; .

Data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; .

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each item.

Installation Procedures; .

Installation procedures for electrical equipment, and preengineered buildings. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test devices and equipment.

As-Built Drawings; .

The as-built drawings shall be a record of the construction as installed. The drawings shall include all the information shown on the contract drawings, deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full-sized set of prints marked to reflect all deviations, changes, and modifications. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction.

The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

Onsite Tests; G, RE.

A detailed description of the Contractor's proposed procedures for on-site tests.

SD-06 Test Reports

Factory Test Reports; G, RE.

Six copies of the information described below in 8 1/2 x 11 inch binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.

- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The conditions specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

Field Test Plan; G, .

A detailed description of the Contractor's proposed procedures for onsite test submitted 20 days prior to testing the installed system. No field test will be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Field Test Reports; G, RE.

Six copies of the information described below in 8 1/2 x 11 inch binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The conditions specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.
- h. Final position of controls and device settings.

SD-07 Certificates

Materials and Equipment; .

The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data

submitted from other testing agency is specifically approved in writing by the Contracting Officer. Items which are required to be listed and labeled in accordance with Underwriters Laboratories must be affixed with a UL label that states that it is UL listed. No exceptions or waivers will be granted to this requirement. Materials and equipment will be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with NFPA 70, recommendations of the manufacturer, and as shown.

1.5 SEISMIC REQUIREMENTS

Seismic requirements shall conform to Section 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

PART 2 PRODUCTS

Products shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.1 CABLES AND WIRES

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to meet manufacturer's requirements.

2.1.2 Insulation

Unless indicated otherwise, or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN, THHN, or THW conforming to UL 83, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW, THW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.1.3 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter;
ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger
diameter.

2.1.4 Service Entrance Cables

Service entrance (SE) and underground service entrance (USE) cables, UL 854.

2.1.5 Cord Sets and Power-Supply Cords

UL 817.

2.2 CIRCUIT BREAKERS

2.2.1 MOLDED-CASE CIRCUIT BREAKERS

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489.
Circuit breakers may be installed in panelboards, switchboards, enclosures.

2.2.1.1 Construction

Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper and aluminum conductors in accordance with UL 486E. Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible.

2.2.1.2 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards and switchboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1. Ratings shall be coordinated with system X/R ratio.

2.2.2 HACR Circuit Breakers

Circuit breakers 60 amperes or below, 240 volts, 1-pole or 2-pole, intended to protect multi-motor and combination-load installations involved in heating, air conditioning, and refrigerating equipment shall be marked "Listed HACR Type."

2.3 CONDUIT AND TUBING

2.3.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797

2.3.2 Electrical Nonmetallic Tubing (ENT)

NEMA TC 13.

2.3.3 Electrical Plastic Tubing and Conduit

NEMA TC 2.

2.3.4 Flexible Conduit, Steel and Plastic

General-purpose type, UL 1; liquid tight, UL 360, and UL 1660.

2.3.5 Intermediate Metal Conduit

UL 1242.

2.3.6 PVC Coated Rigid Steel Conduit

NEMA RN 1.

2.3.7 Rigid Aluminum Conduit

ANSI C80.5 and UL 6.

2.3.8 Rigid Metal Conduit

UL 6.

2.3.9 Rigid Plastic Conduit

NEMA TC 2, UL 651 and UL 651A.

2.3.10 Surface Metal Electrical Raceways and Fittings

UL 5.

2.4 CONDUIT AND DEVICE BOXES AND FITTINGS

2.4.1 Boxes, Metallic Outlet

NEMA OS 1 and UL 514A.

2.4.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

NEMA OS 2 and UL 514C.

2.4.3 Boxes, Outlet for Use in Hazardous (Classified) Locations

UL 886.

2.4.4 Boxes, Switch (Enclosed), Surface-Mounted

UL 98.

2.4.5 Fittings for Conduit and Outlet Boxes

UL 514B.

2.4.6 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing
UL 514B.

2.5 CONDUIT COATINGS PLASTIC RESIN SYSTEM
NEMA RN 1, Type A-40.

2.6 CONNECTORS, WIRE PRESSURE

2.6.1 For Use With Copper Conductors
UL 486A.

2.6.2 For Use With Aluminum Conductors
UL 486B.

2.7 ELECTRICAL GROUNDING AND BONDING EQUIPMENT
UL 467.

2.7.1 Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 not less than 5/8 inch in diameter by 8 feet in length of the sectional type driven full length into the earth.

2.7.2 Ground Bus

The ground bus shall be bare conductor or flat copper in one piece, if practicable.

2.8 ENCLOSURES

NEMA ICS 6 or NEMA 250, unless otherwise specified.

2.8.1 Cabinets and Boxes

Cabinets and boxes with volume greater than 100 cubic inches shall be in accordance with UL 50, hot-dip, zinc-coated, if sheet steel.

2.8.2 Circuit Breaker Enclosures
UL 489.

2.9 LIGHTING FIXTURES, LAMPS, BALLASTS, EMERGENCY EQUIPMENT, CONTROLS AND ACCESSORIES

The following specifications are supported and supplemented by information and details on the drawings. Additional fixtures, if shown, shall conform to this specification. Lamps, lampholders, ballasts, transformers, electronic circuitry and other lighting system components shall be constructed according to industry standards. Equipment shall be tested and listed by a recognized independent testing laboratory for the expected installation conditions. Equipment shall conform to the standards listed below.

2.9.1 Lamps

Lamps shall be constructed to operate in the specified fixture, and shall function without derating life or output as listed in published data. Lamps shall meet the requirements of the Energy Policy Act of 1992.

- a. Incandescent and tungsten halogen lamps shall be designed for 125 volt operation (except for low voltage lamps), shall be rated for minimum life of 2,000 hours, and shall have color temperature between 2,800 and 3,200 degrees Kelvin. Tungsten halogen lamps shall incorporate quartz capsule construction. Lamps shall comply with ANSI C78.20 and sections 238 and 270 of ANSI C78.21.
- b. Fluorescent lamps shall have color temperature 3,000degrees Kelvin. They shall be designed to operate with the ballasts and circuitry of the fixtures in which they will be used. Fluorescent lamps, including spares, shall be manufactured by one manufacturer to provide for color and performance consistency. Fluorescent lamps shall comply with ANSI C78.1. Fluorescent tube lamp efficiencies shall meet or exceed the following requirements.

T8, 32 watts	(4' lamp)	2800 lumens
T12,34 watts	(4' lamp)	2800 lumens
T8,59 watts	(8' lamp)	5700 lumens
T12,60 watts	(8' lamp)	5600 lumens
T8/U,31-32 watts	(U-tube)	2600 lumens
T12/U,34 watts	(U-tube)	2700 lumens

(1) Linear fluorescent lamps, unless otherwise indicated, shall be 4 feet long 32 watt T8, 265 mA, with minimum CRI of 75. Lamps of other lengths or types shall be used only where specified or shown. Lamps shall deliver rated life when operated on [rapid start] [instant start] ballasts [as shown].

2.9.2 Ballasts and Transformers

Ballasts or transformers shall be designed to operate the designated lamps within their optimum specifications, without derating the lamps. Lamp and ballast combinations shall be certified as acceptable by the lamp manufacturer.

- a. Fluorescent ballasts shall comply with ANSI C82.1 and shall be mounted integrally within fluorescent fixture housing unless otherwise shown. Ballasts shall have maximum current crest factor of 1.7; high power factor; Class A sound rating; maximum operating case temperature of 77 degrees F above ambient; and shall be rated Class P. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture. A single ballast may be used to serve multiple fixtures if they are continuously mounted, identically controlled and factory manufactured for that installation with an integral wireway.

(1) Electronic fluorescent ballasts shall comply with 47 CFR 18 for electromagnetic interference. Ballasts shall withstand line transients per IEEE C62.41, Category A. Ballasts shall have total harmonic distortion between 10 and 20%; minimum frequency of 20,000Hz; filament voltage between 2.5 and 4.5 volts; maximum starting inrush current of 20 amperes; and shall comply with the minimum Ballast Efficacy Factors shown in the table below. Minimum starting temperature shall be 50 degrees F. Ballasts shall carry a manufacturer's full warranty of three years, including a minimum \$10 labor allowance per ballast.

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS

LAMP TYPE	TYPE OF STARTER & LAMP	NOMINAL OPERATIONAL VOLTAGE	NUMBER OF LAMPS	MINIMUM BALLAST EFFICACY FACTOR
32W T8	rapid start	120 or 277 V	1	2.54
	linear & U-tubes		2	1.44
			3	0.93
			4	0.73
34W T12	rapid start	120 or 277 V	1	2.64
	linear & U-tubes		2	1.41
			3	0.93
59W T8	rapid start linear	120 or 277 V	2	0.80
60W T12	rapid start linear	120 or 277 V	2	0.80

(3) Magnetic fluorescent ballasts shall be energy-saving, automatic resetting type, approved for the application by the Certified Ballast Manufacturers and complying with ANSI C82.1 and UL 935. Minimum ballast starting temperature shall be 40 degrees F for normal service and 0 degrees F where cold temperature service is required. Magnetic fluorescent ballasts shall have a ballast factor not less than shown in the following table:

MAGNETIC FLUORESCENT BALLAST FACTORS*

Design starting temperature above 40 degrees F with 60 Hz input frequency

LAMP TYPE	NUMBER OF LAMPS	NOMINAL OPERATIONAL INPUT VOLTAGE	TYPE OF STARTER & LAMP	MIN. BALLAST FACTOR
25W F25T8	1	120v	rapid start	.96

MAGNETIC FLUORESCENT BALLAST FACTORS*

	1	277v		.96
	2	120v		.95
	2	277v		.94
32W F32T8	1	120v	rapid start	.96
	1	277v		.95
	2	120v		.85
	2	277v		.96
96W F96T8	1	120 or 277v	instant start	1.10
	2			.85

* For ballasts not specifically designed for use with dimming controls.

2.9.3 Fixtures

Fixtures shall be in accordance with the size, shape, appearance, finish, and performance shown. Unless otherwise indicated, lighting fixtures shall be provided with housings, junction boxes, wiring, lampholders, mounting supports, trim, hardware and accessories for a complete and operable installation. Recessed housings shall be minimum 20 gauge cold rolled or galvanized steel as shown. Extruded aluminum fixtures shall have minimum wall thickness of 0.125 inches. Plastic lenses shall be 100% virgin acrylic or as shown. Glass lenses shall be tempered. Heat resistant glass shall be borosilicate type. Conoid recessed reflector cones shall be Alzak with clear specular low iridescent finish. Gate house and guard houses shall be provided with fixture by the preengineered building manufacturer.

- a. Fluorescent fixtures shall comply with UL 1570. Recessed ceiling fixtures shall comply with NEMA LE 4. Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Marking shall be readily visible to service personnel, but not visible from normal viewing angles. Fluorescent fixture lens frames on recessed and surface mounted troffers shall be one assembly with mitered corners. Parabolic louvers shall have a low iridescent finish and 45 degree cut-off. Louver intersection joints shall be hairline type and shall conceal mounting tabs or other assembly methods. Louvers shall be free from blemishes, lines or defects which distort the visual surface. Integral ballast and wireway compartments shall be easily accessible without the use of special tools. Housings shall be constructed to include grounding necessary to start the lamps. Open fixtures shall be equipped with a sleeve, wire guard, or other positive means to prevent lamps from falling. Medium bi-pin lampholders shall be twist-in type with positive locking position. Long compact fluorescent fixtures and fixtures utilizing U-bend lamps shall have clamps or secondary lampholders to support the free ends of the lamps.

b. Exit Signs

Exit signs shall be ENERGY STAR compliant, thereby meeting the following requirements. Input power shall be less than 5 watts per face. Letter

size and spacing shall adhere to NFPA 101. Luminance contrast shall be greater than 0.8. Average luminance shall be greater than 15 cd/m^2 measured at normal (0 degree) and 45 degree viewing angles. Minimum luminance shall be greater than 8.6 cd/m^2 measured at normal and 45 degree viewing angles. Maximum to minimum luminance shall be less than 20:1 measured at normal and 45 degree viewing angles. The manufacturer warranty for defective parts shall be at least 5 years.

2.9.4 Lampholders, Starters, and Starter Holders

UL 542

2.10 LOW-VOLTAGE FUSES AND FUSEHOLDERS

2.10.1 Fuses, Low Voltage Cartridge Type

NEMA FU 1.

2.10.2 Fuses, High-Interrupting-Capacity, Current-Limiting Type

Fuses, Class G, J, L and CC shall be in accordance with UL 198C.

2.10.3 Fuses, Class K, High-Interrupting-Capacity Type

UL 198D.

2.10.4 Fuses, Class H

UL 198B.

2.10.5 Fuses, Class R

UL 198E.

2.10.6 Fuses, Class T

UL 198H.

2.10.7 Fuses for Supplementary Overcurrent Protection

UL 198G.

2.10.8 Fuses, D-C for Industrial Use

UL 198L.

2.10.9 Fuseholders

UL 512.

2.11 INSTRUMENTS, ELECTRICAL INDICATING

ANSI C39.1.

2.12 PANELBOARDS

Dead-front construction, NEMA PB 1 and UL 67.

2.13 RECEPTACLES

2.13.1 Standard Grade

UL 498.

2.13.2 Ground Fault Interrupters

UL 943, Class A or B.

2.13.3 NEMA Standard Receptacle Configurations

NEMA WD 6.

a. Duplex, 20-Ampere, 125 Volt.

Provide minimum of one duplex receptacle +15" above floor per wall in the gate house and one GFI near sink in the toilet area which all to be connected to the utility power.

Provide minimum one duplex receptacle +15" above floor per wall in the gate house which to be connected to the emergency power. All emergency receptacles shall be color red. Provide one emergency power weather-proof duplex receptacle on the outside of the gate house.

Provide minimum of one duplex receptacle +15" above floor per wall in the each guard houses which to be connected to the utility power.

Provide minimum one duplex receptacle +15" above floor per wall in the each guard houses which to be connected to the emergency power. All emergency receptacles shall be color red. Provide one emergency power weather-proof duplex receptacle on the outside of each guard houses.

See panel schedules on sheet E5.01

2.14 Service Entrance Equipment

UL 869A.

2.15 SPLICE, CONDUCTOR

UL 486C.

2.16 SNAP SWITCHES

UL 20.

2.17 TAPES

2.17.1 Plastic Tape

UL 510.

2.17.2 Rubber Tape

UL 510.

2.18 WIRING DEVICES

NEMA WD 1 for wiring devices, and NEMA WD 6 for dimensional requirements of wiring devices.

2.19 Liquid-Dielectrics

Liquid dielectrics for capacitors, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral oil or less flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall be certified by the manufacturer as having less than 50 parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 50 ppm shall be replaced.

PART 3 EXECUTION

3.1 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following specifications.

3.1.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, 2 additional rods not less than 6 feet on centers shall be driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.1.2 Grounding Conductors

All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70.

3.2 WIRING METHODS

Wiring shall conform to NFPA 70, the contract drawings, and the following specifications. Unless otherwise indicated, wiring shall consist of insulated conductors installed in conduit. Where cables and wires are installed in cable trays, they shall be of the type permitted by NFPA 70 for use in such applications. Wire fill in conduits shall be based on NFPA 70 for the type of conduit and wire insulations specified.

3.2.1 Conduit and Tubing Systems

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be 1/2 inch. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. Nonmetallic conduit and tubing may be used in damp, wet or corrosive locations when permitted by NFPA 70 and the conduit or tubing system is provided with appropriate boxes, covers, clamps, screws or other appropriate type of fittings. Electrical metallic tubing (EMT) may be installed only within buildings. EMT may be installed in concrete and grout in dry locations. EMT installed in concrete or grout shall be provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Aluminum conduit may be used only where installed exposed in dry locations. Nonaluminum sleeves shall be used where aluminum conduit passes through concrete floors and firewalls. Penetrations of above grade floor slabs, time-rated partitions and fire walls shall be firestopped. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70. Raceways shall not be installed under the firepits of boilers and furnaces and shall be kept 6 inches away from parallel runs of flues, steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding.

3.2.1.1 Pull Wires

A pull wire shall be inserted in each empty raceway in which wiring is to be installed if the raceway is more than 50 feet in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 150 feet in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 200 pounds per square inch tensile strength. Not less than 10 inches of slack shall be left at each end of the pull wire.

3.2.1.2 Conduit Stub-Ups

Where conduits are to be stubbed up through concrete floors, a short elbow shall be installed below grade to transition from the horizontal run of conduit to a vertical run. A conduit coupling fitting, threaded on the inside shall be installed, to allow terminating the conduit flush with the finished floor. Wiring shall be extended in rigid threaded conduit to equipment, except that where required, flexible conduit may be used 6 inches above the floor. Empty or spare conduit stub-ups shall be plugged flush with the finished floor with a threaded, recessed plug.

3.2.1.3 Below Slab-on-Grade or in the Ground

Electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel or IMC. Rigid steel or IMC conduits installed below slab-on-grade or

in the earth shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

3.2.1.4 Installing in Slabs Including Slabs on Grade

Conduit installed in slabs-on-grade shall be rigid steel or IMC. Conduits shall be installed as close to the middle of concrete slabs as practicable without disturbing the reinforcement. Outside diameter shall not exceed 1/3 of the slab thickness and conduits shall be spaced not closer than 3 diameters on centers except at cabinet locations where the slab thickness shall be increased as approved by the Contracting Officer. Where conduit is run parallel to reinforcing steel, the conduit shall be spaced a minimum of one conduit diameter away but not less than one inch from the reinforcing steel.

3.2.1.5 Changes in Direction of Runs

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment shall be prevented during the course of construction. Clogged raceways shall be cleared of obstructions or shall be replaced.

3.2.1.6 Supports

Metallic conduits and tubing, and the support system to which they are attached, shall be securely and rigidly fastened in place to prevent vertical and horizontal movement at intervals of not more than 10 feet and within 3 feet of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, beam clamps, or ceiling trapeze. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structure. Loads shall not be applied to joist bridging. Attachment shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Cutting the main reinforcing bars in reinforced concrete beams or joists shall be avoided when drilling holes for support anchors. Holes drilled for support anchors, but not used, shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Raceways shall not be supported using wire or nylon ties. Raceways shall be independently supported from the structure. Upper raceways shall not be used as a means of support for lower raceways. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Cables and raceways shall not be supported by ceiling grids. Except where permitted by NFPA 70, wiring shall not be supported by ceiling support systems. Conduits shall be fastened to sheet-metal boxes and cabinets with two locknuts where required by NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. Additional support for horizontal runs is not

required when EMT rests on steel stud cutouts.

3.2.1.7 Exposed Raceways

Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Raceways under raised floors and above accessible ceilings shall be considered as exposed installations in accordance with NFPA 70 definitions.

3.2.1.8 Exposed Risers

Exposed risers in wire shafts of multistory buildings shall be supported by U-clamp hangers at each floor level, and at intervals not to exceed 10 feet.

3.2.1.9 Communications Raceways

Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirement that no length of run shall exceed 50 feet for 1/2 inch and 3/4 inch sizes, and 100 feet for 1 inch or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of 1 inch size or larger shall not be less than ten times the nominal diameter.

3.2.2 Cables and Conductors

Installation shall conform to the requirements of NFPA 70. Covered, bare or insulated conductors of circuits rated over 600 volts shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 600 volts or less.

3.2.2.1 Sizing

Unless otherwise noted, all sizes are based on copper conductors and the insulation types indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 100 feet long and of 277 volts more than 230 feet long, from panel to load center, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG. Class 3 low-energy, remote-control and signal circuits shall be not less than No. 22 AWG.

3.2.2.2 Use of Aluminum Conductors in Lieu of Copper

Aluminum conductors shall not be used.

3.2.2.3 Conductor Identification and Tagging

Power, control, and signal circuit conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

- a. Color coding shall be provided for service, feeder, branch, and ground conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in the same raceway or box, other neutral shall be white with colored (not green) stripe. The color coding for single-phase low voltage systems shall be as follows:

120/240-volt, 1-phase: Black and red.

- b. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 3 inches of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer.
- c. Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

3.3 BOXES AND SUPPORTS

Boxes shall be provided in the wiring or raceway systems where required by NFPA 70 for pulling of wires, making connections, and mounting of devices or fixtures. Pull boxes shall be furnished with screw-fastened covers. Indicated elevations are approximate, except where minimum mounting heights for hazardous areas are required by NFPA 70. Unless otherwise indicated, boxes for wall switches shall be mounted 48 inches above finished floors. Switch and outlet boxes located on opposite sides of fire rated walls shall be separated by a minimum horizontal distance of 24 inches. The total combined area of all box openings in fire rated walls shall not exceed 100 square inches per 100 square feet. Maximum box areas for individual boxes in fire rated walls vary with the manufacturer and shall not exceed the maximum specified for that box in UL Elec Const Dir. Only boxes listed in UL Elec Const Dir shall be used in fire rated walls.

3.3.1 Box Applications

Each box shall have not less than the volume required by NFPA 70 for number of conductors enclosed in box. Boxes for metallic raceways shall be listed for the intended use when located in normally wet locations, when flush or surface mounted on outside of exterior surfaces, or when located in hazardous areas. Boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. Boxes for mounting lighting fixtures shall be not less than 4 inches square, or octagonal, except smaller boxes may be installed as required by fixture configuration, as approved. Cast-metal boxes with 3/32 inch wall thickness are acceptable. Boxes in other locations shall be sheet steel except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit and tubing or nonmetallic sheathed cable

system, when permitted by NFPA 70. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers.

3.3.2 Brackets and Fasteners

Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screw or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. Penetration of more than 1-1/2 inches into reinforced-concrete beams or more than 3/4 inch into reinforced-concrete joists shall avoid cutting any main reinforcing steel. The use of brackets which depend on gypsum wallboard or plasterboard for primary support will not be permitted. In partitions of light steel construction, bar hangers with 1 inch long studs, mounted between metal wall studs or metal box mounting brackets shall be used to secure boxes to the building structure. When metal box mounting brackets are used, additional box support shall be provided on the side of the box opposite the brackets. This additional box support shall consist of a minimum 12 inch long section of wall stud, bracketed to the opposite side of the box and secured by two screws through the wallboard on each side of the stud. Metal screws may be used in lieu of the metal box mounting brackets.

3.3.3 Mounting in Walls, Ceilings, or Recessed Locations

In walls or ceilings of concrete, tile, or other non-combustible material, boxes shall be installed so that the edge of the box is not recessed more than 1/4 inch from the finished surface. Boxes mounted in combustible walls or ceiling material shall be mounted flush with the finished surface. The use of gypsum or plasterboard as a means of supporting boxes will not be permitted. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be mounted flush with the top of a block to minimize cutting of the blocks, and boxes shall be located horizontally to avoid cutting webs of block. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided.

3.3.4 Installation in Overhead Spaces

In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 24 inches from the box.

3.4 DEVICE PLATES

One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having

rounded or beveled edges. Plates on finished walls shall be of impact-resistant plastic and shall be ivory. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1/16 inch. The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and provided with a hinged, gasketed cover, unless otherwise specified.

3.5 RECEPTACLES

3.5.1 Duplex, 20-ampere, 125 volt

Duplex receptacles shall be rated 20 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of ivory or as indicated. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Only the top receptacle of a duplex receptacle shall be wired for switching application. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided as required by NFPA 70 and as indicated on the drawings.

3.5.2 Weatherproof Applications

Weatherproof receptacles shall be suitable for the environment, damp or wet as applicable, and the housings shall be labeled to identify the allowable use. Receptacles shall be marked in accordance with UL 514A for the type of use indicated; "Damp locations", "Wet Locations", "Wet Location Only When Cover Closed". Assemblies shall be installed in accordance with the manufacturer's recommendations.

3.5.2.1 Damp Locations

Receptacles in damp locations shall be mounted in an outlet box with a gasketed, weatherproof, cast-metal cover plate (device plate, box cover) and a gasketed cap (hood, receptacle cover) over each receptacle opening. The cap shall be either a screw-on type permanently attached to the cover plate by a short length of bead chain or shall be a flap type attached to the cover with a spring loaded hinge.

3.6 WALL SWITCHES

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall be ivory. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than one switch shall be installed in a single-gang position. Switches shall be rated 15-ampere/120-volt for use on alternating current only. Pilot lights indicated shall consist of yoke-mounted candelabra-base sockets rated at 75 watts, 125 volts, and fitted with glass or plastic jewels. A clear 6-watt lamp shall be furnished and installed in each pilot switch. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be red or as indicated in the drawing.

3.7 SERVICE EQUIPMENT

Service-disconnecting means shall be of the enclosed molded-case circuit breaker type with an external handle for manual operation. When service disconnecting means is a part of an assembly, the assembly shall be listed as suitable for service entrance equipment. Enclosures shall be sheet metal with hinged cover for surface mounting unless otherwise indicated.

3.8 PANELBOARDS AND LOADCENTERS

Circuit breakers and switches used as a motor disconnecting means shall be capable of being locked in the open position. Door locks shall be keyed alike. Nameplates shall be as approved. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering. Busses shall be copper.

3.8.1 Loadcenters

Loadcenters shall be circuit breaker equipped.

3.8.2 Panelboards

Panelboards shall be circuit breaker or fusible switch equipped .

3.9 FUSES

Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilize fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination.

3.9.1 Cartridge Fuses; Noncurrent-Limiting Type

Cartridge fuses of the noncurrent-limiting type shall be Class H, nonrenewable, dual element, time lag type and shall have interrupting capacity of 10,000 amperes. At 500 percent current, cartridge fuses shall not blow in less than 10 seconds.

3.9.2 Cartridge Fuses; Current-Limiting Type

Cartridge fuses, current-limiting type, Class RK1 shall have tested interrupting capacity not less than 100,000 amperes. Fuse holders shall be the type that will reject all Class H fuses.

3.9.3 Continuous Current Ratings (600 Amperes and Smaller)

Service entrance and feeder circuit fuses (600 amperes and smaller) shall be Class RK1, current-limiting, nontime-delay with 200,000 amperes interrupting capacity.

3.9.4 Motor and Transformer Circuit Fuses

Motor, motor controller, transformer, and inductive circuit fuses shall be

Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

3.10 UNDERGROUND SERVICE

Unless otherwise indicated, interior conduit systems shall be stubbed out 5 feet beyond the building wall and 2 feet below finished grade, for interface with the exterior service lateral conduits and exterior communications conduits. Outside conduit ends shall be bushed when used for direct burial service lateral conductors. Outside conduit ends shall be capped or plugged until connected to exterior conduit systems. Underground service lateral conductors will be extended to building service entrance and terminated in accordance with the requirements of Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and NFPA 70.

3.11 MOTORS

Each motor shall conform to the hp and voltage ratings indicated, and shall have a service factor and other characteristics that are essential to the proper application and performance of the motors under conditions shown or specified. Three-phase motors for use on 3-phase 208-volt systems shall have a nameplate rating of 200 volts. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40 degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual horsepower ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

3.12 MOTOR-DISCONNECT MEANS

Each motor shall be provided with a disconnecting means when required by NFPA 70 even though not indicated. For single-phase motors, a single or double pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

3.13 LIGHTING FIXTURES, LAMPS AND BALLASTS

This paragraph shall cover the installation of lamps, lighting fixtures and ballasts in interior or building mounted applications.

3.13.1 Lamps

Lamps of the type, wattage, and voltage rating per preengineered building manufacturer. See sheet E5.01 panel schedule to coordinate the voltage. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer. 10% spare lamps of each type, from the original manufacturer, shall be provided.

3.13.2 Lighting Fixtures

Fixtures shall conform to the following specifications. Fixtures of

equivalent energy efficiency, light distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved.

3.13.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

3.13.3 Ballasts

Remote type ballasts or transformers, where indicated, shall be mounted in a well ventilated, easily accessible location, within the maximum operating distance from the lamp as designated by the manufacturer.

3.14 EQUIPMENT CONNECTIONS

Wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits 6 feet or less in length shall be provided to all electrical equipment subject to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

3.14.1 Motors and Motor Control

Motors, motor controls, and motor control centers shall be installed in accordance with NFPA 70, the manufacturer's recommendations, and as indicated. Wiring shall be extended to motors, motor controls, and motor control centers and terminated.

3.15 CIRCUIT PROTECTIVE DEVICES

The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they will function properly prior to the initial energization of the new power system under actual operating conditions.

3.16 FIELD TESTING

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 7 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspection recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the Contractor.

3.16.1 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which

are damaged due to improper test procedures or handling.

3.16.2 Ground-Resistance Tests

The resistance of each grounding electrode or each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Soil resistivity in the area of the grid shall be measured concurrently with the grid measurements. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.

3.16.3 Ground-Grid Connection Inspection

All below-grade ground-grid connections will be visually inspected by the Contracting Officer before backfilling. The Contractor shall notify the Contracting Officer 24 hours before the site is ready for inspection.

3.16.4 Cable Tests

The Contractor shall be responsible for identifying all equipment and devices that could be damaged by application of the test voltage and ensuring that they have been properly disconnected prior to performing insulation resistance testing. An insulation resistance test shall be performed on all low and medium voltage cables after the cables are installed in their final configuration and prior to energization. The test voltage shall be 500 volts DC applied for one minute between each conductor and ground and between all possible combinations of conductors. The minimum value of resistance shall be:

$$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 1000 / (\text{length of cable in feet})$$

Each cable failing this test shall be repaired or replaced. The repaired cable system shall then be retested until failures have been eliminated.

3.16.4.1 Low Voltage Cable Tests

- a. Continuity test.
- b. Insulation resistance test.

3.16.5 Circuit Breaker Tests

The following field tests shall be performed on circuit breakers.

3.16.5.1 Circuit Breakers, Molded Case

- a. Insulation resistance test phase-to-phase, all combinations.
- b. Insulation resistance test phase-to-ground, each phase.

- c. Closed breaker contact resistance test.
- d. Manual operation of the breaker.

3.17 OPERATING TESTS

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph FIELD TEST REPORTS.

3.18 FIELD SERVICE

3.18.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHS format video tape of the entire training shall be submitted.

3.18.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of equipment, assist in the performance of the onsite tests, oversee initial operations, and instruct personnel as to the operational and maintenance features of the equipment.

3.19 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

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SECTION 16520N

EXTERIOR LIGHTING, LED TRAFFIC SIGNAL, AND ELECTRONIC INFORMATION SIGN

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO LTS-3 (1994; R 1998) Structural Supports for
Highway Signs, Luminaires and Traffic
Signals

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C78.1381 (1989; R 1997) Electric Lamps - 70-Watt
M85 Metal-Halide Lamps

ANSI C82.4 (1992) Ballasts for
High-Intensity-Discharge and Low-Pressure
Sodium Lamps (Multiple-Supply Type)

ANSI C136.14 (1988) Roadway Lighting Equipment -
Enclosed Side-Mounted Luminaires for
Horizontal-Burning
High-Intensity-Discharge Lamps

ANSI C136.20 (1990) Roadway Lighting Equipment -
Fiber-Reinforced Plastic (FRP) Lighting
Poles

ANSI C136.21 (1987; R 1997) Roadway Lighting - Vertical
Tenons Used with Post-Top-Mounted
Luminaires

ANSI O5.1 (1992) Wood Poles - Specifications and
Dimensions

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A123/A123M (2000) Zinc (Hot-Dip Galvanized) Coatings
on Iron and Steel Products

ASTM A153/A153M (2000) Zinc Coating (Hot-Dip) on Iron and
Steel Hardware - AASHTO No.: M232

ASTM B108 (1999) Aluminum-Alloy Permanent Mold
Castings

ASTM C1089 (1997) Spun Cast Prestressed Concrete Poles

ASTM G154	(2000) Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)	
AWPA C1	(1999) All Timber Products - Preservative Treatment by Pressure Processes
AWPA C4	(1999) Poles - Preservative Treatment by Pressure Processes
AWPA M6	(1997) Brands Used on Forest Products
ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)	
IES LHBK	(1993) Lighting Handbook, Reference and Application
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)	
IEEE C2	(1997) National Electrical Safety Code (ANSI/IEEE)
IEEE C136.3	(1995) Roadway Lighting Equipment - Luminaire Attachments
IEEE C136.10	(1996) Roadway Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing
IEEE C136.13	(1992; R 1996) Roadway Lighting - Metal Brackets for Wood Poles
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA C78.41	(1995) Electric Lamps - Low-Pressure Sodium Lamps
NEMA C78.42	(1995) Electric Lamps - Guidelines for High-Pressure Sodium Lamps
NEMA C78.1375	(1996) Electric Lamps - 400-Watt, M59 Single-Ended Metal-Halide Lamps
NEMA C78.1376	(1996) Electric Lamps - 1000-Watt, M47 Single-Ended Metal-Halide Lamps
NEMA C78.1377	(1996) Electric Lamps - 175-Watt, M57 Single-Ended Metal-Halide Lamps
NEMA C78.1378	(1996) Electric Lamps - 250-Watt M58 Single-Ended Metal-Halide Lamps
NEMA C78.1379	(1996) Electric Lamps - 1500-Watt, M48 Single-Ended Metal-Halide Lamps

NEMA ICS 2 (1993) Industrial Control and Systems
Controllers, Contactors and Overload
Relays, Rated Not More Than 2000 Volts AC
or 750 Volts DC

NEMA ICS 6 (1993) Industrial Control and Systems
Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 1728F-700 (1993) Wood Poles, Stubs, and Anchor Logs

UNDERWRITERS LABORATORIES (UL)

UL 773 (1995; R 2000) Plug-In, Locking Type
Photocontrols for Use with Area Lighting

UL 773A (1995; R 1999) Nonindustrial Photoelectric
Switches for Lighting Control

UL 1029 (1994; R 1997, Bul. 2000)
High-Intensity-Discharge Lamp Ballasts

UL 1572 (1995; R 1999, Bul. 2000) High Intensity
Discharge Lighting Fixtures

1.2 DEFINITIONS

1.2.1 Average Life

Time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

1.2.2 Groundline Section

That portion between one foot above and 2 feet below the groundline.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Luminaire drawings; G

Poles; G

SD-03 Product Data

Luminaires; G

Lamps; G

Ballasts; G

Lighting contactor; G

Time switch; G

Photocell switch; G

Concrete poles; G

Aluminum poles; G

Steel poles; G

Fiberglass poles; G

Brackets

Auxiliary instant-on quartz system; G

SD-04 Samples

Luminaires; G

Submit one sample of each luminaire type, complete with lamp and ballast. Sample will be returned to the Contractor for installation in the project work.

SD-06 Test Reports

Test Data for luminaires; G

Operating test

Submit operating test results as stated in paragraph entitled "Field Quality Control."

1.4 QUALITY ASSURANCE

1.4.1 Drawing Requirements

1.4.1.1 Luminaire Drawings

Include dimensions, effective projected area (EPA), accessories, and installation and construction details. Photometric data, including zonal lumen data, average and minimum ratio, aiming diagram, and candlepower distribution data shall accompany shop drawings.

1.4.1.2 Poles

Include dimensions, wind load determined in accordance with AASHTO LTS-3, pole deflection, pole class, and other applicable information.

1.4.2 Test Data for Luminaires

- a. Distribution data according to IES classification type as defined in IES LHBK.

- b. Computerized horizontal illumination levels in footcandles at ground level, taken every 20 feet. Include average maintained footcandle level and maximum and minimum ratio.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Aluminum Poles

Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

]PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 16375A, "Electrical Distribution System, Underground".

2.2 LUMINAIRES

ANSI C136.14 or UL 1572. Provide luminaires as indicated. Provide luminaires complete with lamps of number, type, and wattage indicated. Details, shapes, and dimensions are indicative of the general type desired, but are not intended to restrict selection to luminaires of a particular manufacturer. Luminaires of similar designs, light distribution and brightness characteristics, and of equal finish and quality will be acceptable as approved.

2.2.1 Lamps

2.2.1.1 High-Pressure Sodium (HPS) Lamps

NEMA C78.42 Wattage as indicated. HPS lamps shall have average rated life of 16,000 hours (minimum) for 35 watt lamps and 24,000 hours (minimum) for all higher wattage lamps.

2.2.1.2 Electronic Information Sign

Sign shall be LED text messages only with no graphic feature. Fixed font styles, automatic brightness control, and anti-glare face features. Flash memory for permanent backup of messages. Provide 6 feet of data cable coiled within the sign for programming text messages by connecting a laptop locally. Data cable shall be easily accessed through a panel on the back of the sign. All software for text message programming shall be included. Provide cooling package for extended upper operating temperature range. Sign shall be 6 feet above the finished grade to the bottom of the sign. Support sign with 2 steel posts anchored to the ground with a concrete base. The concrete base shall be 1 foot in diameter and 2 feet deep. The top of the concrete base shall be flush with the finished grade.

Pixel Color: Amber

Brightness: Up to 8000 NIT

Viewing Angle: 70 degrees horizontal, 35 degrees vertical

Memory: Minimum 490 KB

Operating Temperature Range: 5 to 120 degrees F.

Operating Humidity: 5% to 95%

Text Line: Minimum 3 lines

Text Character Size: 6"

Total Characters Displayed: Minimum 30

Operating Voltage: 120V, 60Hz

Power Usage: Approx. 150 +/- watts

Enclosure: Metallic for outdoor usage and weather resistance construction.

2.2.1.3 Metal-Halide Lamps

Provide luminaires with tempered glass lens. 175 watt conforming to NEMA C78.1377. 250 watt conforming to NEMA C78.1378.

2.2.1.4 LED Traffic Signal

Signal housing shall be aluminum alloy with door and gasket for use with LED lights. Top light shall be red LED and bottom shall be green LED. Signal shall be mounted on top front of the canopy facing the traffic lane.

Signal housing shall be designed for 8" LED light. Visor shall be formed from aluminum alloy. Visor shall be full circle type and mounted to the face of the housing door with 4 stainless screws. All exterior of the housing, door, and visors shall be painted dull black. Signal shall be controlled by a toggle switch inside the guard and gate house. The signal shall be "ON" red or green position, but not both be "ON" the sametime.

Red LED Light:

LED Quantity:	72
Lamp Wattage:	8 +/- 10%
Chromaticity:	626 nm
Voltage:	80 VAC to 135 VAC
Intensity Regulation:	Yes
Temperature Compensation:	Yes
NEMA 4 Compliance:	Yes
UV Stabilization:	Yes
Replaceable Lens:	Yes

Lens Material:	Tint or Clear Polymeric
Power Factor Correction:	> 0.93
Voltage Spike Protection:	Yes
Total Harmonic Distortion:	< 20%

Green LED Light:

LED Quantity:	72
Lamp Wattage:	9 +/- 10%
Chromaticity:	505 nm
Voltage:	80 VAC to 135 VAC
Intensity Regulation:	Yes
Temperature Compensation:	Yes
NEMA 4 Compliance:	Yes
UV Stabilization:	Yes
Replaceable Lens:	Yes
Lens Material:	Tint or Clear Polymeric
Power Factor Correction:	> 0.93
Voltage Spike Protection:	Yes
Total Harmonic Distortion:	< 20%

2.2.2 Ballasts for High-Intensity-Discharge (HID) Luminaires

UL 1029 and ANSI C82.4, and shall be constant wattage autotransformer (CWA) or regulator, high power-factor type unless otherwise indicated. Provide single-lamp ballasts which shall have a minimum starting temperature of minus 30 degrees C. Ballasts shall be:

- a. Designed to operate on voltage system to which they are connected.
- b. Constructed so that open circuit operation will not reduce the average life.

HPS ballasts shall have a solid-state igniter/starter with an average life in the pulsing mode of 3500 hours at the intended ambient temperature.

Igniter case temperature shall not exceed 90 degrees C.

2.3 PHOTOCELL SWITCH

UL 773 or UL 773A, hermetically sealed cadmium-sulfide or silicon diode type cell rated 240 volts ac, 60 Hz . Switch shall turn on at or below 3 footcandles and off at 2 to 10 footcandles. A time delay shall prevent accidental switching from transient light sources. Provide switch:

- a. integral to the luminaire, rated 1000 VA, minimum.

2.4 POLES

Provide poles designed for wind loading of 100 miles per hour determined in accordance with AASHTO LTS-3 while supporting luminaires having effective projected areas indicated. Poles shall be anchor-base type designed for use with underground supply conductors. Poles shall have oval-shaped handhole having a minimum clear opening of 2.5 by 5 inches. Handhole cover shall be secured by stainless steel captive screws.

2.4.1 Aluminum Poles

Provide aluminum poles manufactured of corrosion resistant aluminum alloys conforming to AASHTO LTS-3 for Alloy 6063-T6 or Alloy 6005-T5 for wrought alloys and Alloy 356-T4 (3,5) for cast alloys. Poles shall be seamless extruded or spun seamless type. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Base covers for aluminum poles shall be cast from 356-T6 aluminum alloy in accordance with ASTM B108.

2.5 BRACKETS AND SUPPORTS

IEEE C136.3, IEEE C136.13, and ANSI C136.21, as applicable. Pole brackets shall be not less than 1 1/4 inch aluminum secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted street lights shall correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head.

2.6 POLE FOUNDATIONS

Anchor bolts shall be steel rod having a minimum yield strength of 50,000 psi; the top 12 inches of the rod shall be galvanized in accordance with ASTM A153/A153M. Concrete shall be as specified in Section 3307a,

2.7 AUXILIARY INSTANT-ON QUARTZ SYSTEM

UL listed, automatically switched instant-on 250-watt quartz lamp. Quartz lamp shall come on when the luminaire is initially energized and immediately after a momentary power outage, and remain on until HID lamp reaches approximately 60 percent light output. Wiring for quartz lamp shall be internal to ballast and independent of incoming line voltage to the ballast. Provide instant-on quartz system as indicated.

PART 3 EXECUTION

3.1 INSTALLATION OF POLES

IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Aluminum

Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end. Provide galvanized nuts, washers, and ornamental covers for anchor bolts. Concrete for anchor bases, polyvinyl chloride (PVC) conduit ells, and ground rods shall be as specified in Section 16375A, "Electrical Distribution System, Underground ."

Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit ell. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.

3.1.2 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations.

3.2 GROUNDING

Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 16375A, "Electrical Distribution System, Underground ." Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.3 FIELD QUALITY CONTROL

Upon completion of installation, conduct an operating test to show that the equipment operates in accordance with the requirements of this section.

-- End of Section --

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SECTION 16710A

PREMISES DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

ANSI/TIA/EIA-568-A	(1995) Commercial Building Telecommunications Cabling Standard
ANSI/TIA/EIA-568-A-5	(2000) Transmission Performance Specifications for 4-pair 100 ohm Category 5E Cabling
ANSI/TIA/EIA-569-A	(1998) Commercial Building Standard for Telecommunications Pathways and Spaces
ANSI/TIA/EIA-606	(1993) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI/TIA/EIA-607	(1994) Commercial Building Grounding and Bonding Requirements for Telecommunications
TIA/EIA TSB 67	(1995) Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems

IBM CORPORATION (IBM)

IBM GA27-3361-07	(1987) LAN Cabling System - Planning and Installation
IBM GA27-3773-0	(1987) Cabling System Technical Interface Specifications

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-80-576	(1994) Communications Wire and Cable for Wiring of Premises
ICEA S-83-596	(1994) Fiber Optic Premises Distribution Cable

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
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UNDERWRITERS LABORATORIES (UL)

UL 50

(1995; Rev thru Nov 1999) Enclosures for
Electrical Equipment

1.2 SYSTEM DESCRIPTION

The premises distribution system shall consist of inside-plant horizontal, riser, and backbone cables and connecting hardware to transport telephone and data (including LAN) signals between equipment items in a building.

1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

1.4 QUALIFICATIONS

1.4.1 Minimum Contractor Qualifications

All work under this section shall be performed by and all equipment shall be furnished and installed by a certified Telecommunications Contractor, hereafter referred to as the Contractor. The Contractor shall have the following qualifications in Telecommunications Systems installation:

- a. Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.
- b. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products.
- c. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.4.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of 3 years experience in producing the types of systems and equipment specified.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Premises Distribution System; G, RE.

Detail drawings including a complete list of equipment and

material. Detail drawings shall contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include vertical riser diagrams, equipment rack details, elevation drawings of telecommunications closet walls, outlet face plate details for all outlet configurations, sizes and types of all cables, conduits, and cable trays. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation.

Record Drawings; G, RE.

Record drawings for the installed wiring system infrastructure per ANSI/TIA/EIA-606. The drawings shall show the location of all cable terminations and location and routing of all backbone and horizontal cables. The identifier for each termination and cable shall appear on the drawings.

SD-03 Product Data

Record Keeping and Documentation; G, RE.

Documentation on cables and termination hardware in accordance with ANSI/TIA/EIA-606.

Spare Parts; .

Lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of detail drawings, not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

Manufacturer's Recommendations; G, RE.

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations, prior to installation shall be provided. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

Test Plan; G, RE.

Test plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 60 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

Qualifications; G, RE.

The qualifications of the Manufacturer, Contractor, and the Installer to perform the work specified herein. This shall include proof of the minimum qualifications specified herein.

SD-06 Test Reports

Test Reports; .

Test reports in booklet form with witness signatures verifying execution of tests. Test results will also be provided on 3-1/2 inch diskettes in ASCII format. Reports shall show the field tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing. Test reports shall be submitted within 7 days after completion of testing.

SD-07 Certificates

Premises Distribution System; .

Written certification that the premises distribution system complies with the ANSI/TIA/EIA-568-A, ANSI/TIA/EIA-569-A, and ANSI/TIA/EIA-606 standards.

Materials and Equipment; .

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

Installers; G, RE.

The Contractor shall submit certification that all the installers are factory certified to install and test the provided products.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.7 OPERATION AND MAINTENANCE MANUALS

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

1.8 RECORD KEEPING AND DOCUMENTATION

1.8.1 Cables

A record of all installed cable shall be provided in hard copy format per ANSI/TIA/EIA-606.

1.8.2 Termination Hardware

A record of all installed patch panels and outlets shall be provided in hard copy format per ANSI/TIA/EIA-606.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.

2.2 UNSHIELDED TWISTED PAIR CABLE SYSTEM

2.2.1 Backbone Cable

Backbone cable shall meet the requirements of ICEA S-80-576 and ANSI/TIA/EIA-568-A for Category 5 100-ohm unshielded twisted pair cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Conductors shall be solid untinned copper 24 AWG. Cable shall be rated per NFPA 70.

2.2.2 Horizontal Cable

Horizontal cable shall meet the requirements of ANSI/TIA/EIA-568-A-5 for Category 5e. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated , as appropriate, per NFPA 70.

2.2.3 Connecting Hardware

Connecting and cross-connecting hardware shall be the same category as the cable it serves. Hardware shall be in accordance with ANSI/TIA/EIA-568-A.

2.2.3.1 Telecommunications Outlets

Wall and desk outlet plates shall come equipped with two modular jacks, with the top or left jack labeled "voice" and the bottom or right jack labeled "data". Modular jacks shall be the same category as the cable they terminate and shall meet the requirements of ANSI/TIA/EIA-568-A. Modular jack pin/pair configuration shall be T568A per ANSI/TIA/EIA-568-A. Modular jacks shall be unkeyed. Faceplates shall be provided and shall be ivory in color, impact resistant plastic. Mounting plates shall be provided for system furniture and shall match the system furniture in color. Outlet assemblies used in the premises distribution system shall consist of modular jacks assembled into both simplex and duplex outlet assemblies in single or double gang covers as specified in this section. The modular jacks shall conform to the requirements of ANSI/TIA/EIA-568-A, and shall be rated for use with Category 5e cable in accordance with ANSI/TIA/EIA-568-A-5 and shall meet the Link Test parameters as listed in TIA/EIA TSB 67 and supplemented by ANSI/TIA/EIA-568-A-5.

2.2.3.2 Patch Panels

Patch panels shall consist of eight-position modular jacks, with rear mounted type 110 insulation displacement connectors, arranged in rows or columns on 19 inch rack mounted panels. Jack pin/pair configuration shall be T568A per ANSI/TIA/EIA-568-A. Jacks shall be unkeyed. Panels shall be provided with labeling space. The modular jacks shall conform to the requirements of ANSI/TIA/EIA-568-A, and shall be rated for use with Category 5e cable in accordance with ANSI/TIA/EIA-568-A-5 and shall meet the Link Test parameters as listed in TIA/EIA TSB 67 and supplemented by ANSI/TIA/EIA-568-A-5.

2.2.3.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible, twisted pair stranded wire with eight-position plugs at each end. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Patch cords shall be wired straight through; pin numbers shall be identical at each end and shall be paired to match T568A patch panel jack wiring per ANSI/TIA/EIA-568-A. Patch cords shall be unkeyed. Patch cords shall be factory assembled. Patch cords shall conform to the requirements of ANSI/TIA/EIA-568-A-5 for Category 5e.

2.2.3.4 Terminal Blocks

Terminal blocks shall be wall mounted wire termination units consisting of insulation displacement connectors mounted in plastic blocks, frames or housings. Blocks shall be type 110 which meet the requirements of ANSI/TIA/EIA-568-A, and shall be rated for use with Category 5e cable in accordance with ANSI/TIA/EIA-568-A-5 and shall meet the Link Test parameters as listed in TIA/EIA TSB 67 and supplemented by ANSI/TIA/EIA-568-A-5. Blocks shall be mounted on standoffs and shall include cable management hardware. Insulation displacement connectors shall terminate 22 or 24 gauge solid copper wire as a minimum, and shall be connected in pairs so that horizontal cable and connected jumper wires are on separate connected terminals.

2.3 SHIELDED TWISTED PAIR CABLE SYSTEM

2.3.1 Backbone Cable

Backbone cable shall meet the requirements of IBM GA27-3773-0 for 150 ohm Shielded Twisted Pair Cable and shall meet or exceed IBM performance requirements for Type 1A cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated per NFPA 70.

2.3.2 Horizontal Cable

Horizontal cable shall meet the requirements of IBM GA27-3773-0 for 150 ohm Shielded Twisted Pair Cable and shall meet or exceed IBM performance requirements for Type 1A cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated per NFPA 70.

2.3.3 Connecting Hardware

2.3.3.1 Connectors

Connectors for shielded twisted pair cable shall meet the requirements of ANSI/TIA/EIA-568-A for media interface connectors and IBM GA27-3773-0 for Type 1A data connectors. Connectors shall be of hermaphroditic design and shall be utilized for outlets and patch panel terminations. Outlet faceplates shall be provided and shall be ivory in color, impact resistant plastic, single gang. Mounting plates shall be provided for systems furniture and shall match the systems furniture in color.

2.3.3.2 Patch Panels

Patch panels shall be 19 inch rack mounted panels with openings for shielded twisted pair connectors. Panels shall be metallic and shall ground the outer shield of the cable. Patch panels shall provide strain relief for cables. Panels shall be provided with labeling space.

2.3.3.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible shielded twisted pair cable with shielded twisted pair type connectors at each end. Cable shall meet the requirements of IBM GA27-3773-0 for 150 ohm Shielded Twisted Pair Cable and shall meet or exceed performance requirements for Type 6A patch panel data cable. Connectors shall meet or exceed the requirements of ANSI/TIA/EIA-568-A for media interface connectors. Patch cords shall be factory assembled.

2.4 FIBER OPTIC CABLE SYSTEM

2.4.1 Backbone Cable

2.4.1.1 Singlemode

Singlemode fiber optic backbone cable shall meet the requirements of ICEA S-83-596 and the following: operation at a center wavelength of 1550 nm; core/cladding diameter 8.3 nominal/125micrometer; maximum attenuation 2.0 dB/km at 1300 nm, 1.75 dB/km at 1550 nm. Numerical aperture for each fiber shall be a minimum of 0.10. Cable construction shall be tight buffered type. Cable shall be imprinted with fiber count and aggregate length at regular intervals. Individual fibers shall be color coded for identification. Cable shall be rated per NFPA 70.

2.4.2 Horizontal Distribution Cable

2.4.2.1 Singlemode

Singlemode fiber optic horizontal cable shall meet the requirements of ICEA S-83-596 and the following: operation at a center wavelength of 1550 nm; core/cladding diameter 8.3 nominal/125 micrometer; maximum attenuation 2.0 dB/km at 1300 nm, 1.75 dB/km at 1550 nm. Numerical aperture for each fiber shall be a minimum of 0.10. Cable construction shall be tight buffered type, two strands. Individual fibers shall be color coded for identification. Cable shall be imprinted with fiber count, fiber type, and aggregate length at regular intervals of 3 feet. Cable shall be rated and marked per NFPA 70.

2.4.3 Connecting Hardware

2.4.3.1 Connectors

Connectors shall be SC type with ceramic ferrule material with a maximum

insertion loss of .5 dB. Connectors shall meet performance requirements of ANSI/TIA/EIA-568-A. Connectors shall be field installable. Connectors shall utilize adhesive for fiber attachment to ferrule. Connectors shall terminate fiber sizes as required for the service. Station cable faceplates shall be provided and shall be ivory in color, impact resistant plastic, single gang, with double-sided female SC coupler. Mounting plates shall be provided for system furniture and shall match the furniture system in color.

2.4.3.2 Patch Panels

Patch panels shall be a complete system of components by a single manufacturer, and shall provide termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection. Patch panels shall be 19 inch rack mounted panels. Patch panels shall provide strain relief for cables. Panels shall be provided with labeling space. Patch panel connectors and couplers shall be the same type and configuration as used elsewhere in the system.

2.4.3.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible optical fiber cable with connectors of the same type as used elsewhere in the system. Optical fiber shall be the same type as used elsewhere in the system. Patch cords shall be complete assemblies from manufacturer's standard product lines.

2.5 EQUIPMENT RACKS

2.5.1 Floor Mounted Open Frame

Floor mounted equipment racks shall be aluminum relay racks with uprights to mount equipment 19 inches wide. Uprights shall be 3 inch deep channel, 1-1/4 inches wide, drilled and tapped 12-24 in a 1/2 inch pattern. Racks shall be provided with a standard top crossmember, and predrilled base plate to allow floor fastening. Open frame equipment racks shall be 7 feet in height and clear coated. AC outlets shall be provided.

2.5.2 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 19 inch equipment racks. Cable guides shall consist of ring or bracket-like devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lockwashers.

2.5.3 Wall Mounted Cabinets

Wall mounted cabinets shall conform to UL 50 and have boxes constructed of zinc-coated sheet steel with dimensions not less than shown on drawings. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum openings to the box interiors. Boxes shall be provided with 3/4 inch plywood backboard painted white or a light color. A duplex AC outlet shall be installed within the cabinet.

2.6 EQUIPMENT MOUNTING BACKBOARD

Plywood backboards shall be provided, sized as shown, painted with white or

light colored paint.

2.7 TELECOMMUNICATIONS OUTLET BOXES

Electrical boxes for telecommunication outlets shall be 4-11/16 inch square by 2-1/8 inches deep with minimum 3/8 inch deep single or two gang plaster ring as shown. Provide a minimum 1 inch conduit.

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Components shall be labeled in accordance with ANSI/TIA/EIA-606. Penetrations in fire-rated construction shall be firestopped in accordance with Section 07840 FIRESTOPPING. Conduits, outlets and raceways shall be installed in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Wiring shall be installed in accordance with ANSI/TIA/EIA-568-A and as specified in Section 16415 ELECTRICAL WORK, INTERIOR. Wiring, and terminal blocks and outlets shall be marked in accordance with ANSI/TIA/EIA-606. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Horizontal Distribution Cable

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Fiber optic cables shall be installed either in conduit or through type cable trays to prevent microbending losses. Copper cable not in a wireway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided. Cables shall be terminated; no cable shall contain unterminated elements. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.

3.1.2 Riser and Backbone Cable

Vertical cable support intervals shall be in accordance with manufacturer's recommendations. Cable bend radius shall not be less than ten times the outside diameter of the cable during installation and once installed. Maximum tensile strength rating of the cable shall not be exceeded. Cable shall not be spliced.

3.1.3 Telecommunications Outlets

Provide one communication outlet per wall and two above the counter for the gate house. Provide two communication outlets above the counter for all the guard houses. Each outlet shall be terminated back to a

communication cabinet or panel located inside the gate or guard houses with 4 pairs of CAT5e cable in 3/4" conduit.

3.1.3.1 Faceplates

As a minimum each jack shall be labeled as to its function and a unique number to identify cable link.

3.1.3.2 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 6 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturers bend radius for each type of cable shall not be exceeded.

3.1.3.3 Pull Cords

Pull cords shall be installed in all conduit serving telecommunications outlets which do not initially have fiber optic cable installed.

3.1.4 Terminal Blocks

Terminal blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Industry standard wire routing guides shall be utilized.

3.1.5 Unshielded Twisted Pair Patch Panels

Patch panels shall be mounted in equipment racks with sufficient modular jacks to accommodate the installed cable plant plus 10 percent spares. Cable guides shall be provided above, below and between each panel.

3.1.6 Fiber Optic Patch Panels

Patch panels shall be mounted in equipment racks with sufficient ports to accommodate the installed cable plant plus 10 percent spares. A slack loop of fiber shall be provided within each panel. Loop shall be provided as recommended by the manufacturer. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

3.1.7 Equipment Racks

Open frame equipment racks shall be bolted to the floor slab. Cable guides shall be bolted or screwed to racks. Racks shall be installed level. Ganged racks shall be bolted together. Ganged rack cabinets shall have adjacent side panels removed. Wall mounted racks shall be secured to the mounting surface to prevent fully loaded racks from separating from the mounting surface.

3.1.8 Rack Mounted Equipment

Equipment to be rack mounted shall be securely fastened to racks by means of the manufacturer's recommended fasteners.

3.2 TERMINATION

Cables and conductors shall sweep into termination areas; cables and

conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.

3.2.1 Unshielded Twisted Pair Cable

Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels. No cable shall be unterminated or contain unterminated elements. Pairs shall remain twisted together to within the proper distance from the termination as specified in ANSI/TIA/EIA-568-A. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket.

3.2.2 Shielded Twisted Pair Cable

Each cable shall be terminated on panel-mounted connectors. Cables shall be grounded at patch panels using manufacturer's recommended methods. Shield braid shall be continuous to connector braid terminator. Wire insulation shall not be damaged when removing shield.

3.2.3 Fiber Optic Cable

Each fiber shall have connectors installed. The pull strength between the connector and the attached fiber shall be not less than 25 pounds. The mated pair loss, without rotational optimization, shall not exceed 1.0 dB. Fiber optic connectors shall be installed per ANSI/TIA/EIA-568-A.

3.3 GROUNDING

Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with ANSI/TIA/EIA-607 and Section 16415 ELECTRICAL WORK, INTERIOR. Equipment racks shall be connected to the electrical safety ground.

3.4 ADDITIONAL MATERIALS

The Contractor shall provide the following additional materials required for facility startup.

- a. 10 of each type outlet.
- b. 10 of each type cover plate.
- c. 1 of each type terminal block for each telecommunications closet.
- d. 4 Patch cords of 10 feet for each telecommunications closet.
- e. 1 Set of any and all special tools required to establish a cross connect and to change and/or maintain a terminal block.

3.5 ADMINISTRATION AND LABELING

3.5.1 Labeling

3.5.1.1 Labels

All labels shall be in accordance with ANSI/TIA/EIA-606.

3.5.1.2 Cable

All cables will be labeled using color labels on both ends with identifiers per ANSI/TIA/EIA-606.

3.5.1.3 Termination Hardware

All workstation outlets and patch panel connections will be labeled using color coded labels with identifiers per ANSI/TIA/EIA-606.

3.6 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

3.6.1 Unshielded Twisted Pair Tests

All metallic cable pairs shall be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room. Backbone wiring shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective communications closets. These test shall be completed and all errors corrected before any other tests are started.

3.6.2 Category 5e Circuits

All category 5e circuits shall be tested using a test set that meets the Class II accuracy requirements of TIA/EIA TSB 67 standard, including the additional tests and test set accuracy requirements of ANSI/TIA/EIA-568-A-5. Testing shall use the Basic Link Test procedure of TIA/EIA TSB 67, as supplemented by ANSI/TIA/EIA-568-A-5.. Cables and connecting hardware which contain failed circuits shall be replaced and retested to verify the standard is met.

3.6.3 Shielded Twisted Pair

Wiring configuration shall be tested for continuity, opens, shorts, swaps and correct pin configuration; dc resistance both pair-to-pair and wire-to-shield shall be verified. Cable lengths shall be verified. Near end crosstalk shall be tested from 772 kHz to 300 MHz. Ground potential difference between wiring closets, ground potential difference between patch panel and wall outlet, and ground path resistance shall be tested per IBM GA27-3361-07.

3.6.4 Fiber Optic Cable

Unless stated otherwise, tests shall be performed from both ends of each circuit. Connectors shall be visually inspected for scratches, pits or chips and shall be reterminated if any of these conditions exist. Each circuit leg and complete circuit shall be tested for insertion loss at 1310

and 1550 nm using a light source similar to that used for the intended communications equipment. High-resolution optical time domain reflectometer (OTDR) tests shall be performed from one end of each fiber. Scale of the OTDR trace shall be such that the entire circuit appears over a minimum of 80 percent of the X-axis.

-- End of Section --

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SECTION 16711A

TELEPHONE SYSTEM, OUTSIDE PLANT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C62.61	(1993) Gas Tube Surge Arrestors on Wire Line Telephone Circuits
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2239	(1996a) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
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ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/EIA 455-81A-91	(1992) FOTP-81 Compound Flow (Drip) Test for Filled Fiber Optic Cable
EIA ANSI/EIA/TIA-455-30B	(1991) FOTP-30 Frequency Domain Measurement of Multimode Optical Fiber Information Transmission Capacity
EIA ANSI/EIA/TIA-455-53A	(1990) FOTP-53 Attenuation by Substitution Measurement for Multimode Graded-Index Optical Fibers or Fiber Assemblies Used in Long Length Communications Systems
EIA ANSI/EIA/TIA-455-78A-98	(1990; R 1998) FOTP-78 Spectual Attenuation Cutback Measurement for Single Mode Optical Fibers
EIA ANSI/TIA/EIA-568-A	(1995) Commercial Building Telecommunications Cabling Standard
EIA ANSI/TIA/EIA-607	(1994) Commercial Building Grounding and Bonding Requirements for Telecommunications

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
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INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-85-625	(1996) Airecore, Polyolefin Insulated, Copper Conductor Telecommunications Cable
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

REA Bulletin 345-39 (1985) Telephone Station Protectors

REA Bulletin 345-50 (1979) Trunk Carrier Systems (PE-60)

REA Bulletin 345-65 (1985) Shield Bonding Connectors (PE-33)

REA Bulletin 345-72 (1985) Filled Splice Closures (PE-74)

REA Bulletin 345-151 (1989) Conduit and Manhole Construction, REA Form 515c

REA Bulletin 1753F-205 (PE-39) (1993) Filled Telephone Cables

REA Bulletin 1753F-207 (PE-87) (1994) Terminating Cables

REA Bulletin 1753F-208 (1993) Filled Telephone Cables with Expanded Insulation (PE-89)

RUS Bulletin 1751F-635 (1996) Aerial Plant Construction

RUS Bulletin 1751F-643 (1998) Underground Plant Design

RUS Bulletin 1753F-302 (PE-91) (1994) Outside Plant Housings and Serving Area Interface Systems

RUS Bulletin 1753F-401(PC-2) (1995) Splicing Copper and Fiber Optic Cables

RUS REA Bulletin 1751F-641 (1995) Construction of Buried Plant

RUS REA Bull 1753F-201 (PC-4) (1997) Acceptance Tests and Measurements of Outside Plant

RUS REA Bull 1753F-601 (PE-90) (1994) Filled Fiber Optic Cables

RUS REA Bulletin 1755I-100 (1999) List of Materials Acceptable for Use on Telecommunications Systems of RUS Borrowers

UNDERWRITERS LABORATORIES (UL)

UL 50 (1995; Rev thru Oct 1997) Enclosures for Electrical Equipment

UL 497 (1995; Rev Mar 1996) Protectors for Paired Conductor Communication Circuits

1.2 SYSTEM DESCRIPTION

The outside plant system shall consist of all cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards,

terminating cables, lightning and surge protection modules at the entry facility. The work consists of furnishing, installing, testing and making operational a complete outside plant system for continuous use.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telephone System;
Installation;

Detail drawings, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, and catalog cuts. Detail drawings shall also contain complete configuration information, wiring diagrams and any other details required to demonstrate that the cable system has been coordinated to support the transmission systems identified in the specifications and drawings. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operations.

Record Drawings; G, RE

Record drawings for the installed wiring system showing the actual location of all cable terminations, splices, routing, and size and type of all cables. The identifier for each termination and cable shall appear on the drawings. The drawings shall include gauge and pair or fiber count for each cable, duct and innerduct arrangement, or conductor assignment of outside plant, and protector and connector block layout at the termination points after installation.

SD-03 Product Data

Spare Parts;
Equipment;

A data list of recommended spare parts, tools, and test equipment for each different item of material and equipment specified prior to beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Installation; G, RE

Printed copies of the manufacturer's recommendations for the material being installed, prior to installation. Installation of the item will not be allowed to proceed where installation procedures, or any part thereof, are required to be in accordance with those recommendations until the recommendations are received and approved.

Acceptance Tests; G, RE

Test plans defining all tests required to ensure that the system meets specified requirements. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

Cutover and Records; G, RE

The cutover plan shall provide procedures and schedules for relocation of facility station numbers without interrupting service to any active location.

SD-06 Test Reports

Acceptance Tests;

Test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be tabulated on a pair by pair or strand by strand basis.

SD-07 Certificates

Telephone System;

Proof that the items furnished under this section conform to the specified requirements in FCC, ICEA, REA, RUS, ANSI, ASTM, NFPA, EIA, or UL, where materials and equipment are so specified.

Qualifications; G, RE

The qualifications of the manufacturer, splicer, and installation supervisor as specified.

1.4 QUALIFICATIONS

1.4.1 Cable Installers

Installation shall be under the direct supervision of an individual with a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.4.2 Cable Splicing and Termination

All cable splicers shall have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices shall be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

1.4.3 Manufacturers

The cable, equipment, and hardware provided shall be from manufacturers that have a minimum of 3 years experience in producing the types of cable, equipment, and hardware specified.

1.5 DELIVERY AND STORAGE

1.5.1 Cable Requirements-

All cable shall be shipped on reels. The diameter of the drum shall be large enough to prevent damage to the cable during reeling and unreeling. The reels shall be constructed to prevent damage during shipment and handling. The outer end of the cable shall be securely fastened to the reel head to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel, or into a housing on the inner slot of the drum, with sufficient length to make it available for testing. The inner end shall be fastened to prevent the cable from becoming loose during installation. End seals shall be applied to each of the cables to prevent moisture from entering the cable. The reels with cable shall be suitable for outside storage conditions when the temperature ranges from minus 40 to plus 148 degrees F, with relative humidity from 0 to 100 percent.

1.5.2 Equipment

All equipment shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants, in accordance with the manufacturer's requirements.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening. Each major component of equipment shall have the manufacturer's name and type identified on the equipment. All products supplied shall be specifically designed and manufactured for use with outside plant communications systems. All items of the same class of equipment shall be the products of a single manufacturer.

2.2 CABLE

2.2.1 Copper Conductor Cable

Copper conductor cable shall conform to the following:

2.2.1.1 Aerial

- a. Lashed: REA Bulletin 1753F-208.
- b. Self Supporting: ICEA S-85-625.

2.2.1.2 Direct Buried

Cable shall be manufactured per REA Bulletin 1753F-208 or REA Bulletin 345-39. A metallic shield shall be provided.

2.2.1.3 Underground

Cable shall be manufactured per REA Bulletin 1753F-205 (PE-39) or REA Bulletin 1753F-208. A metallic shield shall be provided.

2.2.1.4 Screened

Screened cable shall comply with REA Bulletin 1753F-205 (PE-39) or REA Bulletin 1753F-208.

2.2.2 Fiber Optic Cable

Fiber optic cable shall be specifically designed for outside use with tight or loose buffer construction. The tight buffer optical fiber cable shall consist of a central glass optical fiber surrounded by a soft intermediate buffer to allow for thermal expansions and proper fitting of the secondary buffer. The loose buffer optical fiber cable shall have the glass optical fiber within a filled loose tube. All fiber optic cables used shall conform to the requirements of RUS REA Bull 1753F-601 (PE-90) including any special requirements made necessary by a specialized design..

2.2.2.1 Cable Cores

A central, nonmetallic core member shall be included to serve as a cable core foundation to reduce strain on the fibers, but not to serve as a pulling strength member.

2.2.2.2 Optical Fiber

Single-mode optical fibers shall be Class IV. Multi-mode optical fibers shall be Class Ia.

2.2.2.3 Shielding or Other Metallic Covering

A metallic covering or shield shall be provided per RUS REA Bull 1753F-601 (PE-90).

2.2.2.4 Performance Requirements

The fiber optic cable shall comply with the specified mechanical performance requirements while used in buried and underground duct applications where the temperature varies from minus 5 to plus 140 degrees F. Optical performance degradation shall be less than 5 percent of the optical performance requirements in the temperature range of minus 5 to plus 140 degrees F. The fiber optic cable shall not be damaged in storage where the temperature may vary from minus 40 to plus 148 degrees F.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Aerial Closure

The aerial closure shall be free breathing and suitable for housing straight and butt splices of non-pressurized communications cables. The closure shall be constructed with ultraviolet resistant PVC.

2.3.1.2 Buried Closure

Buried closure shall conform to REA Bulletin 345-72.

2.3.1.3 Underground Closure

Underground closures shall conform to REA Bulletin 345-72. The closure shall be of thermoplastic, thermoset, or stainless steel material and be suitable for use in a vault or manhole.

2.3.2 Fiber Optic Closures

2.3.2.1 Fiber Optic Aerial

The aerial closure shall be free breathing and suitable for housing a splice organizer of non-pressurized communications cables. The closure shall be constructed with ultraviolet resistant PVC.

2.3.2.2 Fiber Optic Buried

The buried closure shall be suitable for enclosing a splice organizer in a container into which can be poured an encapsulating compound. The closure shall protect the splice and be suitable for use in the buried environment.

The encapsulating compound shall be re-enterable and shall not alter the chemical stability of the closure.

2.3.2.3 Fiber Optic Underground

The underground closure shall be suitable to house a splice organizer in a protective housing. An encapsulating compound shall be poured into this enclosure. The closure shall be of thermo-plastic, thermoset-plastic, or stainless steel material and suitable for use in a vault or manhole. The encapsulating compound shall be re-enterable and shall not alter the chemical stability of the closure.

2.4 CABLE SPLICES AND ORGANIZERS

2.4.1 Copper Cable Splices

All cables greater than 25 pairs shall be spliced using modular splicing connectors, which accommodate 25 pairs of conductors at a time. The correct connector size shall be used to accommodate the wire gauge of the cable to be spliced. The connectors used shall be listed in RUS REA Bulletin 1755I-100.

2.4.2 Fiber Optic Cable Splices

Each fiber optic splice shall be physically protected by a splice kit. The kit shall be specially designed for the splice.

2.4.3 Fiber Optic Splice Organizer

The splice organizer shall be suitable for housing fiber optic splices in a neat and orderly fashion. The splice organizer shall allow for a minimum of 3 feet of fiber for each fiber within the cable to be neatly stored without kinks or twists. The splice organizer shall accommodate individual strain relief for each splice. The splice organizer shall allow for future maintenance or modification, without damage to the cable or splices. All required splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors shall be provided in the organizer kit.

2.5 CABLE TERMINALS

2.5.1 Pedestal-Type Cable Terminals

Pedestal-type cable terminals shall conform to RUS Bulletin 1753F-302 (PE-91).

2.5.2 Cross-connect Cable Terminals

Cross-connect cable terminals shall be weatherproofed for outdoor use and suitable for pole, pad, or stake mounting. The terminal shall be equipped with mounting columns and distribution rings for jumper-wire routing. The terminal shall be of aluminum or steel construction and ribbed for strength.

2.6 MANHOLE AND DUCT

All manhole and duct products shall conform to RUS Bulletin 1751F-643.

2.6.1 New Manholes

New manholes shall be equipped with pulling-in irons, cable racks, and ground rod, and conform to the requirements of REA Bulletin 345-151. Manholes shall be a minimum of 12 feet long by 6 feet wide by 6.5 feet high. Manholes shall be designed so that the main trunk conduits enter and exit near the center of the ends, and lateral conduits exit on the sides near the corners. Manholes may be pre-cast or cast in place.

2.6.2 Manhole Overbuilds

Existing manholes which are enlarged as part of this project shall be equipped with new pulling-in irons, cable racks, and ground rod.

2.6.3 Duct/Conduit

Conduit shall be furnished as specified in Sections 16415 ELECTRICAL WORK, INTERIOR and 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and as shown on project drawings.

2.6.4 Innerduct

Innerduct shall be SIDR 11.5 polyethylene plastic pipe conforming to ASTM D 2239.

2.7 EQUIPMENT RACKS

Distribution frames, cabinets, and back-boards shall be provided as shown and designed to mount connector blocks, protector blocks, cross connects, and other hardware required to terminate and protect the outside telephone plant cable; to provide a demarcation point between inside and outside plant cable; and to allow inside and outside plant cable to be cross connected.

2.7.1 Floor Mounted Open Frame

Floor mounted equipment racks shall be single sided aluminum relay racks with uprights to mount equipment 19 inches wide. Uprights shall be 3 inch deep channel, 1-1/4 inch wide, drilled and tapped 12-24 in a 1/2 inch pattern. Racks shall be provided with a standard top cross-member, and predrilled base plate to allow floor fastening. Open frame equipment racks shall be 7 feet in height and painted. AC outlets shall be provided.

2.7.2 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on [19] [23] inch equipment racks. Cable guides shall consist of ring or bracket-like

devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lock-washers.

2.7.3 Floor Mounted Cabinets

Equipment cabinets shall be floor mounted enclosures with side panels, acrylic plastic front doors, rear louvered metal doors, depth-adjustable front and rear mounting rails, and louvered top. Ventilation fans [shall] [shall not] be included. Vertical cable management devices shall be integral to the cabinet. Power strips with 6 outlets shall be mounted within the cabinet. Equipment racks shall mount equipment 19 inches wide and shall be 72 inches high and 30 inches deep. Cabinet exteriors shall be painted blue.

2.7.4 Wall Mounted Cabinets

Wall mounted cabinets shall conform to UL 50 and have boxes constructed of zinc-coated sheet steel with dimensions not less than shown on drawings. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum openings to the box interiors. Boxes shall be provided with 3/4 inch plywood backboard painted white or a light color. A duplex AC outlet shall be installed within the cabinet.

2.7.5 Equipment Mounting Backboard

Backboards shall be 3/4 inch AC plywood, sized as shown, painted with white or light colored paint.

2.8 CONNECTOR BLOCKS

Connector blocks consisting of flame-retardant molded plastic fastened to a metal mounting bar shall be provided to terminate the outside plant cable as shown. The connector blocks shall be of 100-pair block size and equipped with protection modules. The connector blocks shall be 24 gauge stub type. The cable stubs shall be 100 pair and conform to REA Bulletin 1753F-207 (PE-87).

2.9 PROTECTOR MODULES

The protector modules shall be of the two-element gas tube type. Protection modules shall be heavy duty, A>10 kA, B>400, C>65A where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current per ANSI C62.61. The gas modules shall shunt high voltage to ground, fail short, be equipped with an external spark gap and heat coils, and shall comply with UL 497.

2.10 FIBER-OPTIC TERMINATIONS

2.10.1 Fiber Optic Connectors

All outside plant fiber strands shall be terminated in a SC type fiber optic connector, with ceramic ferrule material and a maximum insertion loss of 0.5 dB. Connectors shall meet performance standards of EIA ANSI/TIA/EIA-568-A. If pre-connectorized cable assemblies or pigtails are used, the connectors shall be terminated on a 10 foot length of single-fiber cable. The single-fiber cable shall contain a buffered optical fiber of the same type and specification as that used in the multi-fiber cable.

2.10.2 Fiber Optic Patch Panels

Patch panels shall be a complete system of components by a single manufacturer, and shall provide termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection. Patch panels shall be 19 inch rack mounted panels. Patch panels shall provide strain relief for cables. Panels shall be labeled with alphanumeric x-y coordinates. Patch panel connectors and couplers shall be the same type and configuration as used elsewhere in the system.

2.11 MISCELLANEOUS ITEMS

2.11.1 Shield Connectors

Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire. The connector shall be made of tin-plated tempered brass. Shield bond connectors shall comply with REA Bulletin 345-65.

2.11.2 Grounding Braid

Grounding braid shall provide low electrical impedance connections for dependable shield bonding. The braid shall be made from flat tin-plated copper.

2.11.3 Warning Tape

Marking and locating tape shall be acid and alkali resistant polyethylene film, 6 inches wide with a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing, or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The metallic core shall be encased in a protective jacket or provided with other means to protect it from corrosion and shall be specifically manufactured for marking and locating underground utilities. The warning tape shall be orange in color and continuously imprinted with the words "WARNING - COMMUNICATIONS CABLE BELOW" at not more than 48 inch intervals.

2.11.4 Cable Warning Signs

Cable warning signs, which identify the route of buried cable, shall be stake mounted. The stake shall be driven into undisturbed soil and the sign shall be mounted to the stake in accordance with the manufacturer's instructions. Warning signs shall be placed at intervals of no more than 500 feet and at each change of direction in the cable route. Warning signs shall also be placed on each side of every crossing of surface obstacles such as roads, railroads, stream crossings, or any similar crossing where excavation is likely to occur.

PART 3 EXECUTION

3.1 INSTALLATION

All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and as shown. All installation work shall be done in accordance with the safety requirements set forth in the general requirements of IEEE C2 and NFPA 70.

3.1.1 Cable Inspection and Repair

All cable and wire used in the construction of the project shall be handled with care. Each reel shall be inspected for cuts, nicks or other damage. All damage shall be repaired to the satisfaction of the Contracting Officer. The reel wrap shall remain intact on the reel until the cable or wire is ready to be placed.

3.1.2 Buried Cable

Buried cable installation shall be accomplished in accordance with RUS REA Bulletin 1751F-641.

3.1.2.1 Cable Depth

Cables placed in soil shall be at a minimum depth of 24 inches. Cables placed at ditch crossings shall be at a minimum depth of 36 inches. A warning tape shall be placed above the cable and approximately 18 inches below ground level. Cables placed in rock shall be at a minimum depth of 6 inches.

3.1.2.2 Above Ground Cable Protection

Cable installed on the outside of buildings, less than 8 feet above finished grade, shall be protected against physical damage.

3.1.2.3 Telephone Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter.

3.1.2.4 Penetrations

Penetrations in walls, ceilings or other parts of the building, made to provide for cable access, shall be caulked and sealed. Where conduits and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in Section 07840 FIRESTOPPING. Fire stopped penetrations shall not compromise the fire rating of the walls or floors. All underground building entries shall be through waterproof facilities.

3.1.2.5 Cable Protection

Unless otherwise shown or specified, direct buried cable shall be protected in accordance with Table 300.5 of NFPA 70. Where additional protection is required, cable may be placed in galvanized iron pipe (GIP) sized on a maximum fill of 40% of cross-sectional area, or in concrete encased 4 inch PVC pipe. Conduits shall extend at least 6 inches per 12 inches burial depth beyond the edge of the surface where cable protection is required; all conduits shall be sealed on each end. Conduit may be installed by jacking or trenching. Trenches shall be backfilled with earth and mechanically tamped at 6 inch lifts so that the earth is restored to the same density, grade and vegetation as adjacent undisturbed material.

3.1.2.6 Backfill for Rocky Soil

When placing cable in a trench in rocky soil, the cable shall be cushioned by a fill of sand or selected soil at least 2 inches thick on the floor of the trench before placing the cable or wire. The backfill for at least 4

inches above the wire or cable shall be free from stones, rocks, or other hard or sharp materials which might damage the cable or wire. If the buried cable is placed less than 24 inches in depth, a protective cover of concrete shall be used.

3.1.1.3 Underground Cable

Underground cable installation shall be accomplished in accordance with the requirements set forth in RUS REA Bulletin 1751F-641.

3.1.3.1 Cable Pulling

For cable installed in ducts and conduit, a cable feeder guide shall be used, between the cable reel and the face of the duct and conduit, to protect the cable and guide it into the duct and conduit as it is paid off the reel. As the cable is paid off the reel, it shall be inspected for jacket defects. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. Cable shall be hand fed and guided through each manhole. As the cable is paid off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. Where the cable is pulled through a manhole, additional lubricant shall be applied at all intermediate manholes. Dynamometers or load-tension instruments shall be used to ensure that the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed upon a cable during installation shall not cause the cable to be twisted or stretched.

3.1.3.2 Penetrations for Cable Access

Penetrations in walls, ceilings or other parts of the building, made to provide for cable access, shall be caulked and sealed. Where conduits and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials. Fire stopped penetrations shall not compromise the fire rating of the walls or floors. All underground building entries shall be through waterproof facilities.

3.1.3.3 Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter. Only large radius sweeps shall be used in conduit runs and shall not exceed a cumulative 90 degrees between manholes.

3.1.1.4 Aerial Cable

Aerial cable installation shall be accomplished in accordance with the requirements set forth in RUS Bulletin 1751F-635.

3.1.1.5 Manhole and Ducts

Manhole and duct systems shall be installed in accordance with Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Manholes shall be placed in line with the main duct. Splice cases shall be mounted in the center on the long sides. Lateral conduits shall exit the long sides near the corners.

3.1.5.1 Innerduct Installation

Innerduct shall be pulled through existing duct-manhole system in continuous sections. Splices, joints, couplings, or connections of any type will not be allowed between manholes. Innerduct shall be plugged at both ends with polyurethane foam duct seal; this material shall also be inserted between the innerduct and the duct if cables are placed in the innerducts. Only one cable shall be installed in a given innerduct. Existing and new unoccupied innerducts shall be trimmed leaving 2 inches exposed.

3.1.5.2 Pull Cord

Pull cords of 3/8 inch polypropylene shall be installed in all unused ducts and inner-ducts with a minimum of 2 feet spare cord protruding from each end.

3.1.6 Surge Protection

Except for fiber optic cable, all cables and conductors, which serve as communication lines, shall have surge protection meeting the requirements of REA Bulletin 345-50 installed at the entry facility.

3.2 SPLICING

3.2.1 Copper Conductor Splices

Copper conductor cable splicing shall be accomplished in accordance with RUS Bulletin 1753F-401(PC-2). Modular splicing shall be used on all cables larger than 25 pairs.

3.2.2 Fiber Optic Splices

Fiber optic splicing shall be in accordance with the manufacturer's recommendation; each splice shall have a loss of less than 0.1 dB.

3.3 GROUNDING

Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals shall be grounded. Grounding shall be in accordance with requirements of NFPA 70, Articles 800-33 and 800-40.

3.3.1 Ground Bars

3.3.1.1 Telecommunications Master Ground Bar (TMGB)

A copper TMGB shall be provided, in accordance with EIA ANSI/TIA/EIA-607, to be the hub of the basic grounding system by providing a common point of connection for ground from outside cable, MDF, and equipment. The TMGB shall have a ground resistance, including ground, of 10 ohms or less.

3.3.1.2 Telecommunications Ground Bar (TGB)

Copper TGB shall be provided in accordance with EIA ANSI/TIA/EIA-607 in each communications closet and room and each frame. The TGB shall be connected to the TMGB in accordance with EIA ANSI/TIA/EIA-607. Each TGB shall be connected to the TMGB by the most direct route utilizing a copper wire conductor with a total resistance of less than 0.01 ohms.

3.3.2 Incoming Outside Plant Cables

All incoming outside plant cable shields shall be bonded directly to the TMGB or the closest TGB.

3.3.3 Cable Stubs

All shields of cable stubs shall be bonded to a TGB located on the frame.

3.3.4 Shields

The shields of all incoming cables shall not be bonded across the splice to the cable stubs.

3.3.5 Protection Assemblies

The protector assemblies shall be mounted directly on the vertical frame ironwork. The assemblies mounted on each vertical frame shall be connected with a No. 6 AWG copper conductor to provide a low resistance path to the TGB.

3.3.6 Manholes

The shields of all cables in each manhole shall be bonded together by a bonding wire or ribbon. At intermediate manholes, where the cable is pulled through without a sheath opening, bonds are not required. If the manhole has a lacerating bonding ribbon, the shields of spliced cables shall be attached to it.

3.4 CUTOVER AND RECORDS

All necessary transfers and cutovers, shall be accomplished by the Contractor.

3.5 ACCEPTANCE TESTS

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test; testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. The test plans shall define all the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

3.5.1 Copper Conductor Cable

The following acceptance tests shall be performed in accordance with RUS REA Bull 1753F-201 (PC-4):

- a. Shield continuity.
- b. Conductor continuity.
- c. Conductor insulation resistance.
- d. Structural return loss.

- e. Cable insertion loss and loss margin at carrier frequencies.
- f. Shield ground for single jacketed cables.
- g. DC loop resistance.

3.5.2 Fiber Optic Cable

Two optical tests shall be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. In addition, a Bandwidth Test shall be performed on all multi-mode optical fibers. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single fiber cable assembly.

3.5.2.1 OTDR Test

The OTDR test shall be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings, improper splices, for the cable span under test. Hard copy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, 3280 feet minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. The OTDR test shall be conducted in accordance with EIA ANSI/EIA 455-81A-91 for single-mode fiber and EIA ANSI/EIA/TIA-455-78A-98 for multi-mode fiber. Splice losses shall not exceed 0.1db. Attenuation losses shall not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber. Attenuation losses shall not exceed 5.0 db/km at 850 nm and 1.5 db/km at 1300 nm for multi-mode fiber.

3.5.2.2 Attenuation Test

End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 850 nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met. The measurement method shall be in accordance with EIA ANSI/EIA/TIA-455-53A.

3.5.2.3 Bandwidth Test

The end-to-end bandwidth of all multi-mode fiber span links shall be measured by the frequency domain method. The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with EIA ANSI/EIA/TIA-455-30B.

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SECTION 16751A

CLOSED CIRCUIT TELEVISION SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15 Radio Frequency Devices

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA 170 (1957) Electrical Performance Standards - Monochrome Television Studio Facilities

EIA ANSI/EIA/TIA-232-F (1997) Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange

EIA ANSI/EIA-310-D (1992) Cabinets, Racks, Panels, and Associated Equipment

EIA ANSI/EIA-330 (1968) Electrical Performance Standards for Closed Circuit Television Camera 525/60 Interlaced 2:1

EIA ANSI/EIA-375-A-1976 (1974) Electrical Performance Standards for Direct View Monochrome Closed Circuit Television Monitors 525/60 Interlaced 2:1

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (1997) National Electrical Safety Code

IEEE C62.41 (1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits

IEEE Std 142 (1991) IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1997) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(1999) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1410

(1997; R Nov 1998) Television Receivers
and High-Voltage Video Products

1.2 SYSTEM DESCRIPTION

1.2.1 General

The Contractor shall obtain the services of a CCTV engineer to design, supervise, and configure the CCTV system as described and shown. All television equipment shall conform to EIA 170 specifications. The system shall include all connectors, adapters, and terminators necessary to interconnect all equipment. The Contractor shall also supply all cabling necessary to interconnect the closed circuit television (CCTV) equipment installed in the Security Police Center (Building #326), and interconnect equipment installed at the Gate House, Guard Houses, and the Dome camera.

1.2.2 System Overall Reliability Requirement

The system, including all components and appurtenances, shall be configured and installed to yield a mean time between failure (MTBF) of at least 10,000 hours, and shall be calculated based on the configuration specified in paragraph "System Overall Reliability Calculations."

1.2.3 Power Line Surge Protection

All equipment connected to AC power shall be protected from surges. Equipment protection shall withstand surge test waveforms described in IEEE C62.41. Fuses shall not be used for surge protection.

1.2.4 Video and Sync Signal Transmission Line Surge Protection

All cable, except fiber optic cable, used for sync or video signal transmission shall include protective devices to safeguard the CCTV equipment against surges. The surge suppression device shall not attenuate or reduce the video or sync signal under normal conditions. The surge suppression device shall be capable of dissipating not less than 1500 watts for 1 millisecond, and the response time from zero volts to clamping shall not be greater than 5 nanoseconds. Fuses shall not be used for surge protection.

1.2.5 Control Line Surge Protection

All cables and conductors, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against surges and shall have surge protection installed at each end. Protection shall be furnished at the equipment and additional triple electrode gas surge protectors rated for the application on each wireline circuit shall be installed within 3 feet of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following waveforms:

- a. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

- b. An 8 microsecond rise time by 20 microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

1.2.6 Power Line Conditioners

A power line conditioner with UPS shall be furnished for the security console CCTV equipment. The power line conditioner used for the CCTV equipment shall be as recommended by the CCTV engineer. The power line conditioner shall be of the ferroresonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power line side. The power line conditioner shall be sized for 125 percent of the actual connected kVA load. Characteristics of the power line conditioner shall be as follows:

- a. At 85 percent load, the output voltage shall not deviate by more than plus or minus 1 percent of nominal when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.
- b. During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus 3 percent of nominal. Full correction of load switching disturbances shall be accomplished within 5 cycles, and 95 percent correction shall be accomplished within 2 cycles of the onset of the disturbance.
- c. Total harmonic distortion shall not exceed 3-1/2 percent at full load.

1.2.7 Video and Control Signal Data Transmission Media

The Contractor shall provide a video and data and control signal transmission system as recommended by the CCTV engineer

1.2.8 Environmental Conditions

1.2.8.1 Field Equipment

The cameras and all other field equipment shall be rated for continuous operation under ambient environmental conditions of 14 degrees to 120 degrees F using no auxiliary heating or cooling equipment. Equipment shall be rated for continuous operation under the ambient environmental temperature, humidity, wind loading, ice loading, and vibration conditions specified or encountered for the installed location.

1.2.8.2 Security Center Equipment

Security Police Center, Gate House and Guard Houses control/monitoring equipment shall, unless designated otherwise, be rated for continuous operation under ambient environmental conditions of 60 degrees F to 85 degrees F and a relative humidity of 20 to 80 percent.

1.2.9 Electrical Requirements

Electrically powered CCTV equipment shall operate on 120 volt 60 Hz AC sources. Equipment shall be able to tolerate variations in the voltage source of plus or minus 10 percent, and variations in the line frequency of plus or minus 2 percent with no degradation of performance.

1.2.10 Uninterruptible Power Supply

All electrical and electronic equipment in the console shall be powered from an UPS . The UPS shall be sized to provide at least 5 minutes battery back-up in the event of utility power failure, that is to insure the CCTV system will not be interrupted until the generator activated. Batteries for the UPS shall be sealed non-outgassing type.

1.3 DELIVERY OF TECHNICAL DATA AND COMPUTER SOFTWARE

All items of computer software and technical data (including technical data which relates to computer software), which are specifically identified in this specification shall be delivered strictly in accordance with the CONTRACT CLAUSES, SPECIAL CONTRACT REQUIREMENTS, Section 01330 SUBMITTAL PROCEDURES, and in accordance with the Contract Data Requirements List (CDRL), DD Form 1423, which is attached to and thereby made a part of this contract. All data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. Final design of the CCTV system shall be submitted to DOIM for review and approval before start of construction

1.3.1 Group I Technical Data Package

1.3.1.1 System Drawings

The data package shall include the following:

- a. System block diagram.
- b. CCTV system console installation, block diagrams, and wiring diagrams.
- c. Security center CCTV equipment installation, interconnection with console equipment, block diagrams and wiring diagrams.
- d. Remote control/monitoring station installation, interconnection to security center including block diagrams and wiring diagrams.
- e. Camera wiring and installation drawings.
- f. Pan/tilt mount wiring and installation drawings.
- g. Interconnection with video signal transmission system, block diagrams and wiring diagrams.
- h. Surge protection device installation.

1.3.1.2 Manufacturers' Data

The data package shall include manufacturers' data for all materials and equipment and security center equipment provided under this specification.

1.3.1.3 System Description and Analyses

The data package shall include complete system descriptions, analyses and calculations used in sizing the equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance of this specification. The data package

shall include the following:

- a. Switcher matrix size.
- b. Camera call-up response time.
- c. System start up and shutdown operations.
- d. Switcher programming instructions.
- e. Switcher operating and maintenance instructions.
- f. Manuals for CCTV equipment.
- g. Data entry forms.

1.3.1.4 Software Data

The data package shall consist of descriptions of the operation and capability of system and application software as specified.

1.3.1.5 Overall System Reliability Calculations

The data package shall include all manufacturer's reliability data and calculations required to show compliance with the specified reliability. The calculations shall be based on all CCTV equipment associated with one camera circuit and the console CCTV equipment, excluding the data transmission media (DTM).

1.3.1.6 Certifications

All specified manufacturer's certifications shall be included with the data package.

1.3.2 Group II Technical Data Package

The Contractor shall verify that site conditions are in agreement with the design package. The Contractor shall submit a report to the Government documenting changes to the site, or conditions that affect performance of the system to be installed. For those changes or conditions which affect system installation or performance, provide (with the report) specification sheets, or written functional requirements to support the findings, and a cost estimate to correct the deficiency. The Contractor shall not correct any deficiency without written permission from the Government.

1.3.3 Group III Technical Data Package

The Contractor shall prepare test procedures and reports for the predelivery test. The Contractor shall deliver the predelivery test procedures to the Government for approval. After receipt by the Contractor of written approval of the predelivery test procedures, the Contractor may schedule the predelivery test. The final predelivery test report shall be delivered after completion of the predelivery test.

1.3.4 Group IV Technical Data Package

The Contractor shall prepare test procedures and reports for the performance verification test and the endurance test. The Contractor shall deliver the performance verification test and endurance test procedures to

the Government for approval. After receipt by the Contractor of written approval of the test procedures, the Contractor may schedule the tests. The contractor shall provide a report detailing the results of the field test and a video tape as specified in paragraph "Contractor's Field Testing." The final performance verification and endurance test report shall be delivered after completion of the tests.

1.3.4.1 Operation and Maintenance Manuals

A draft copy of the operation and maintenance manuals, as specified for the Group V technical data package, shall be delivered to the Government prior to beginning the performance verification test for use during site testing.

1.3.4.2 Training Documentation

Lesson plans and training manuals for the training phases, including type of training to be provided with a sample training report, and a list of reference material, shall be delivered for approval.

1.3.4.3 Data Entry

The Contractor shall enter all data needed to make the system operational. The Contractor shall deliver the data to the Government on data entry forms, utilizing data from the contract documents, Contractor's field surveys, and all other pertinent information in the Contractor's possession required for complete installation of the data base. The Contractor shall identify and request from the Government, any additional data needed to provide a complete and operational CCTV system. The completed forms shall be delivered to the Government for review and approval at least 90 days prior to the Contractor's scheduled need date.

1.3.4.4 Graphics

Where graphics are required and are to be delivered with the system, the Contractor shall create and install all graphics needed to make the system operational. Graphics shall have sufficient level of detail for the system operator to assess the alarm. The Contractor shall supply hard copy, color examples at least 8 by 10 inches in size, of each type of graphic to be used for the completed CCTV system. If the video switcher does not use a monitor for display of system information, the Contractor shall provide examples of the video annotation used for camera identification. The graphics examples shall be delivered to the Government for review and approval at least 90 days prior to the Contractor's scheduled need date.

1.3.5 Group V Technical Data Package

Final copies of each of the manufacturer's commercial manuals arranged as specified bound in hardback, loose-leaf binders, shall be delivered to the Government within 30 days after completing the endurance test. The draft copy used during site testing shall be updated prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance. The number of copies of each manual to be delivered shall

be as specified on DD Form 1423.

1.3.5.1 Functional Design Manual

The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes.

1.3.5.2 Hardware Manual

A manual shall describe all equipment furnished, including:

- a. General hardware description and specifications.
- b. Installation and checkout procedures.
- c. Equipment electrical schematics and layout drawings.
- d. System schematics and wiring lists.
- e. System setup procedures.
- f. Manufacturer's repair parts list indicating sources of supply.
- g. Interface definition.

1.3.5.3 Software Manual

The software manual shall describe the functions of all software, and shall include all other information necessary to enable proper loading, testing and operation, including:

- a. Definitions of terms and functions.
- b. Procedures for system boot-up.
- c. Description of using the programs.
- d. Description of required operational sequences.
- e. Directory of all disk files.
- f. Description of all communications protocols, including data formats, command characters, and a sample of each type of data transfer.

1.3.5.4 Operator's Manual

The operator's manual shall explain all procedures and instructions for operation of the system including:

- a. Video switcher.
- b. Video multiplexer.
- c. Cameras and video recording equipment.

- d. Use of the software.
- e. Operator commands.
- f. System start-up and shut-down procedures.
- g. Recovery and restart procedures.

1.3.5.5 Maintenance Manual

The maintenance manual shall describe maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.3.5.6 As-Built Drawings

The Contractor shall maintain a separate set of drawings, elementary diagrams and wiring diagrams of the CCTV system to be used for as-built drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the CCTV system and shall be delivered to the Government with the final endurance test report. In addition to being complete and accurate, this set of drawings shall be kept neat and shall not be used for installation purposes. Upon completion of the final system drawings, a representative of the Government will review the final system work with the Contractor. If the final system work is not complete, the Contractor will be so advised and shall complete the work as required. Final drawings submitted with the endurance test report shall be finished drawings on mylar or vellum, and as AutoCAD or Microstation files on CD-ROM.

1.4 TESTING

1.4.1 General

The Contractor shall perform predelivery testing, site testing, and adjustment of the completed CCTV system. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the Government at least 14 days prior to the test, and in no case shall notice be given until after the Contractor has received written approval of the specific test procedures.

1.4.2 Test Procedures and Reports

Test procedures shall explain, in detail, step-by-step actions and expected results demonstrating compliance with the requirements of the specification. Test reports shall be used to document results of the tests. Reports shall be delivered to the Government within 7 days after completion of each test.

1.5 TRAINING

1.5.1 General

The Contractor shall conduct training courses for designated personnel in the maintenance and operation of the CCTV system as specified. The training shall be oriented to the specific system being installed under this contract. Training manuals shall be delivered for each trainee with two additional manuals delivered for archiving at the project site. The manuals shall include an agenda, defined objectives for each lesson, and a

detailed description of the subject matter for each lesson. The Contractor is responsible for furnishing all audio-visual equipment and all other training materials and supplies. Where the Contractor presents portions of the course through the use of audio-visual material, copies of the audio-visual materials shall be delivered to the Government, either as a part of the printed training manuals or on the same media as that used during the training sessions. A training day is 8 hours of instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the facility. For guidance in planning the required instruction, the Contractor should assume the attendees will have a high school education or equivalent. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

1.5.2 Operator's Training

The course shall be taught at the project site for five consecutive training days during or after the Contractor's field testing. A maximum of 12 personnel will attend the course. No part of the training given during this course will be counted toward completion of the performance verification test. The course shall consist of classroom instruction, hands-on training, instruction on the specific hardware configuration of the installed system, and specific instructions for operating the installed system. The course shall demonstrate system start up, system operation, system shutdown, system recovery after a failure, the specific hardware configuration, and operation of the system and its software. The students should have no unanswered questions regarding operation of the installed CCTV system. The Contractor shall prepare and insert additional training material in the training manuals when the need for additional material becomes apparent during instruction. The Contractor shall prepare a written report after the completion of the course. The Contractor shall list in the report the times, dates, attendees and material covered at each training session. The Contractor shall describe the skill level of each student at the end of this course. The Contractor shall submit the report before the end of the performance verification test. The course shall include:

- a. General CCTV hardware, installed system architecture and configuration.
- b. Functional operation of the installed system and software.
- c. Operator commands.
- d. Alarm interfaces.
- e. Alarm reporting.
- f. Fault diagnostics and correction.
- g. General system maintenance.
- h. Replacement of failed components and integration of replacement components into the operating CCTV system.

1.6 MAINTENANCE AND SERVICE

1.6.1 General Requirements

The Contractor shall provide all services required and equipment necessary to maintain the entire CCTV system in an operational state as specified for a period of 1 year after completion of the endurance test, and shall provide all necessary material required for the work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other unscheduled work.

1.6.2 Description of Work

The adjustment and repair of the CCTV system includes all computer equipment, software updates, signal transmission equipment, and video equipment. Provide the manufacturer's required adjustments and all other work necessary.

1.6.3 Personnel

Service personnel shall be qualified to accomplish all work promptly and satisfactorily. The Government shall be advised in writing of the name of the designated service representative, and of any changes in personnel.

1.6.4 Schedule of Work

The Contractor shall perform two inspections at 6-month intervals or less. This work shall be performed during regular working hours, Monday through Friday, excluding legal holidays. These inspections shall include:

- a. Visual checks and operational tests of the CPU, switcher, peripheral equipment, interface panels, recording devices, monitors, video equipment electrical and mechanical controls, and a check of the picture quality from each camera.
- b. Run system software and correct all diagnosed problems.
- c. Resolve any previous outstanding problems.

1.6.5 Emergency Service

The Government will initiate service calls when the CCTV system is not functioning properly. Qualified personnel shall be available to provide service to the complete CCTV system. The Government shall be furnished with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at the site within 24 hours after receiving a request for service. The CCTV system shall be restored to proper operating condition within 3 calendar days after receiving a request for service.

1.6.6 Operation

Performance of scheduled adjustments and repair shall verify operation of the CCTV system as demonstrated by the applicable portions of the performance verification test.

1.6.7 Records and Logs

The Contractor shall keep records and logs of each task, and shall organize cumulative records for each major component, and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain calibration, repair, and programming data. Complete logs shall be kept and shall be available for inspection on site,

demonstrating that planned and systematic adjustments and repairs have been accomplished for the CCTV system.

1.6.8 Work Requests

The Contractor shall separately record each service call request, as received. The form shall include the serial number identifying the component involved, its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion. The Contractor shall deliver a record of the work performed within 5 days after work is completed.

1.6.9 System Modifications

The Contractor shall make any recommendations for system modification in writing to the Government. No system modifications, including operating parameters and control settings, shall be made without prior approval of the Government. Any modifications made to the systems shall be incorporated into the operations and maintenance manuals, and other documentation affected.

1.6.10 Software

The Contractor shall recommend all software updates to the Government for approval. Upon Government approval, updates shall be accomplished in a timely manner, fully coordinated with the CCTV system operators, operation in the system verified, and shall be incorporated into the operations and maintenance manuals, and software documentation. There shall be at least one scheduled update near the end of the first year's warranty period, at which time the Contractor shall install and validate the latest released version of the manufacturer's software.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

All system hardware and software components shall be produced by manufacturers regularly engaged in the production of CCTV equipment. Units of the same type of equipment shall be products of a single manufacturer. All material and equipment shall be new and currently in production. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. Equipment located at the security center or a remote control/monitoring station shall be rack mounted as shown. Both Television and Computing devices shall comply with 47 CFR 15, Subpart B.

2.1.1 Soldering

All soldering shall be done in accordance with standard industry practices.

2.2 ENCLOSURES

The Contractor shall provide metallic enclosures as needed for equipment not housed in racks or supplied with a housing. The enclosures shall be as specified or shown.

2.2.1 Interior

Enclosures to house equipment in an interior environment shall meet the requirements of NEMA 250 Type 12.

2.2.2 Exposed-to-Weather

Enclosures to house equipment in an outdoor environment shall meet the requirements of NEMA 250 Type 4X.

2.2.3 Corrosion-Resistant

Enclosures to house equipment in a corrosive environment shall meet the requirements of NEMA 250 Type 4X.

2.3 TAMPER PROVISIONS

Enclosures, cabinets, housings (other than environmental camera housings), boxes, raceways, conduits, and fittings of every description having hinged doors or removable covers, and which contain any part of the CCTV equipment or power supplies, shall be provided with cover operated, corrosion-resistant tamper switches, arranged to initiate an alarm signal when the door or cover is moved. Tamper switches shall be mechanically mounted to maximize the defeat time when enclosure covers are opened or removed. The enclosure and the tamper switch shall function together to not allow direct line of sight to any internal components and tampering with the switch or the circuits before the switch activates. Tamper switches shall be inaccessible until the switch is activated; have mounting hardware concealed so that the location of the switch cannot be observed from the exterior of the enclosure; be connected to circuits which are under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating; shall be spring-loaded and held in the closed position by the door cover; and shall be wired so that they break the circuit when the door or cover is disturbed. Tamper switches on the doors which must be opened to make routine maintenance adjustments to the system and to service the power supplies shall be push/pull-set, automatic reset type.

2.3.1 Enclosure Covers

Covers of pull and junction boxes provided to facilitate installation of the system need not be provided with tamper switches if they contain no splices or connections, but shall be protected by tack welding or brazing the covers in place. Zinc labels shall be affixed to such boxes indicating they contain no connections. These labels shall not indicate that the box is part of the security system.

2.3.2 Conduit-Enclosure Connections

All conduit-enclosure connections shall be protected by tack welding or brazing the conduit to the enclosure. Tack welding or brazing shall be done in addition to standard conduit-enclosure connection methods as described in NFPA 70.

2.4 LOCKS AND KEY-LOCK OPERATED SWITCHES

2.4.1 Locks

Keys shall be stamped "U.S. GOVT. DO NOT DUP." The locks shall be so arranged that the key can only be withdrawn when in the locked position.

All maintenance locks shall be keyed alike and only two keys shall be furnished for all of these locks.

2.4.2 Key-Lock-Operated Switches

All key-lock-operated switches required to be installed on system components shall be UL listed. Keys shall be stamped "U.S. GOVT. DO NOT DUP." Key-lock-operated switches shall be two position, with the key removable in either position. All key-lock-operated switches shall be keyed differently and only two keys shall be furnished for each key-lock-operated-switch.

2.5 SOLID STATE CAMERAS

2.5.1 High Resolution Monochrome Camera

The video camera shall conform to EIA 170 and EIA ANSI/EIA-330 specifications. All electronic components and circuits shall be solid state. Signal-to-noise ratio shall not be less than 46 dB unweighted. The camera shall exhibit no geometric distortion. The lens mount shall be a C or CS-mount, and the camera shall have a back focus adjustment. The camera shall operate from minus 4 to 131 degrees F without auxiliary heating or cooling, and with no change in picture quality or resolution. The camera shall operate on 60 Hz AC power, and shall be capable of operating at a voltage of 105 to 130 Volts.

2.5.1.1 Solid State Image Array

The camera shall have a solid state imager, and the picture produced by the camera shall be free of blemishes as defined by EIA ANSI/EIA-330. The camera shall provide not less than 550 lines of horizontal resolution, and resolution shall not vary over the life of the camera.

2.5.1.2 Sensitivity

Camera shall provide full video output with the infrared cut-off filter installed, without camera automatic gain, and a scene reflectance of 75 percent using an f/1.2 lens giving a camera faceplate illumination at 2850K of 0.1 footcandle.

2.5.1.3 Camera Synchronization

The camera shall have an input for external sync, and shall automatically switch over to internal sync if external sync is not present. The camera shall also have the capability of synchronization by line-locking to the AC power 60 Hz line frequency at the zero crossing point, and shall provide not less than plus or minus 90 degrees of vertical phase adjustment.

2.5.1.4 Connectors

Cameras with lenses having auto iris, manual iris, or zoom and focus functions shall be supplied with connectors and wiring as needed to operate the lens functions. Video signal output connector shall be a BNC. Cameras with integral fiber optic video transmitters shall have straight-tip bayonet type fiber optic video output connectors. A connector shall be provided for external sync input.

2.5.1.5 Automatic Circuits

The camera shall have circuitry to establish a reference black level as described in EIA ANSI/EIA-330, and an automatic white clipper and automatic gain control circuits.

2.5.2 Dome Cameras

2.5.2.1 Exterior Dome Camera System

An exterior dome camera system shall be provided with integral camera installed and integrated into the dome housing. The camera shall have a minimum horizontal resolution of 425 lines (color) or 500 lines (monochrome). The dome housing shall be nominally 6 inches and shall be furnished in a NEMA 4 pendant mount, pole mount, ceiling mount, surface mount, or corner mount as shown. The housing shall be constructed to be dust and water tight, and fully operational in 100 percent condensing humidity. The housing shall be equipped with supplementary camera mounting blocks or supports as needed to position the specified camera and lens to maintain the proper optical centerline. All electrical and signal connections required for operation of the camera and lens shall be supplied. The housing shall protect the internal drives, positioners, and camera from the environment encountered for camera operation. The lower dome shall be tinted acrylic and shall have a light attenuation factor of not more than 1 f-stop. An integral heater, sized to maintain the lower dome above the dew point, shall be part of the camera system. The housing shall be equipped with integral pan/tilt complete with wiring, wiring harnesses, connectors, receiver/driver, pan/tilt control system, pre-position cards, or any other hardware and equipment as needed to provide a fully functional pan/tilt dome. The pan/tilt shall have heavy duty bearings and hardened steel gears. The pan/tilt shall be permanently lubricated. The motors shall be thermally or impedance protected against overload damage. Pan movement shall be 360 degrees and tilt movement shall not be less than plus and minus 90 degrees. Pan speed shall not be less than 20 degrees per second, and tilt speed shall not be less than 10 degrees per second. There shall not be less than 99 preset positions, with positioning speeds of at least 360 degrees per second in the automatic mode, and not less than 120 degrees per second in the manual positioning mode, with a positioning accuracy of plus or minus 1/2 degree. Each set of preset position data shall include auto focus, auto iris, pan, tilt, and zoom functions. The system shall be able to automatically scan between any two electronically-set limits, and shall be able to operate in the "tour" mode covering up to all presets in a user defined sequence. The dome system shall withstand temperature ranges from minus 40 to 122 degrees F over a humidity range of 0 to 90 percent, non-condensing.

2.6 CAMERA LENSES

Camera lenses shall be all glass with coated optics. The lens mount shall be a C or CS mount, compatible with the cameras selected. The lens shall be supplied with the camera, and shall have a maximum f-stop opening of f/1.2 or the maximum available for the focal length specified. The lens shall be equipped with an auto-iris mechanism unless otherwise specified. Lenses having auto iris, manual iris, or zoom and focus functions shall be supplied with connectors, wiring, receiver/drivers, and controls as needed to operate the lens functions. Lenses shall have sufficient circle of illumination to cover the image sensor evenly. Lenses shall not be used on a camera with an image format larger than the lens is designed to cover. Lens focal lengths shall be as shown or specified in the manufacturer's lens selection tables.

2.7 CAMERA HOUSINGS AND MOUNTS

The camera and lens shall be enclosed in a tamper resistant housing as specified below. Any ancillary housing mounting hardware needed to install the housing at the camera location shall be provided as part of the housing. The camera and lens contained in a camera housing shall be installed on a camera support as shown. Any ancillary mounting hardware needed to install the support and to install the camera on the support shall be provided as part of the support. The camera support shall be capable of supporting the equipment to be mounted on it including wind and ice loading normally encountered at the site.

2.7.1 Environmentally Sealed Camera Housing

The housing shall be designed to provide a condensation free environment for camera operation. The housing shall be constructed to be dust and water tight, and fully operational in 100 percent condensing humidity. The housing shall be purged of atmospheric air and pressurized with dry nitrogen, shall be equipped with a fill valve, overpressure valve, and shall have a humidity indicator visible from the exterior. Housing shall not have a leak rate greater than 2 pounds per square inch at sea level within a 90 day period. The housing shall be equipped with supplementary camera mounting blocks or supports as needed to position the specified camera and lens to maintain the proper optical centerline. All electrical and signal connections required for operation of the camera and lens shall be supplied. The housing shall provide the environment needed for camera operation, and shall keep the viewing window free of fog, snow, and ice. The housing shall be equipped with a sunshield, and both the housing and the sunshield shall be white. A mounting bracket which can be adjusted to center the weight of the housing and camera assembly shall be provided as part of the housing.

2.7.2 Exterior Wall Mount

The exterior camera wall mount shall be 16 inches long, and shall have an adjustable head for mounting the camera. The wall mount and head shall be constructed of aluminum, stainless steel, or steel with a corrosion-resistant finish. The head shall be adjustable for not less than plus and minus 90 degrees of pan, and not less than plus and minus 45 degrees of tilt. If the bracket is to be used in conjunction with a pan/tilt, the bracket shall be supplied without the adjustable mounting head, and shall have a bolt hole pattern to match the pan/tilt base.

2.8 VIDEO MONITOR

2.8.1 Monochrome Video Monitor

The monitor shall conform to EIA 170, EIA ANSI/EIA-375-A-1976, and UL 1410 specifications. All electronic components and circuits shall be solid state except for the picture tube. The monitor shall operate on 120 volts 60 Hz AC power, shall have a stabilized high voltage power supply, and regulated low voltage power supplies. The monitor shall have automatic frequency control (AFC), bandwidth greater than 7 MHz, and horizontal resolution not less than 700 lines at the center of the picture tube. The monitor shall be capable of reproducing a minimum of 10 discernable shades of gray as described in EIA ANSI/EIA-375-A-1976. The video input shall accept composite video with switchable loop-through or 75 ohm termination. The monitor shall operate on 60 Hz AC power, and shall be capable of operating at a voltage of 105 to 130 Volts.

2.8.2 Picture Tube

The monitor shall have a 12 inch picture tube measured diagonally.

2.8.3 Configuration

The monitor shall be configured in a cabinet or rack mount with approval of the Contracting Officer . Monitors shall not interfere with each other when rack mounted or operated next to each other as described in EIA ANSI/EIA-375-A-1976.

2.8.4 Controls

Front panel controls shall be provided for power on/off, horizontal hold, vertical hold, contrast, and brightness. The monitor shall have switchable DC restoration.

2.8.5 Connectors for Video Monitor

Video signal input and output shall be by BNC connectors.

2.9 VIDEO SWITCHER

The switcher shall conform to EIA 170 specifications, and shall be a vertical interval switcher. Electronic components, subassemblies, and circuits of the switcher shall be solid state. The switcher shall be microprocessor based and software programmable. The switcher shall be a modular system that shall allow for expansion or modification of inputs, outputs, alarm interfaces, and secondary control stations by addition of the appropriate modules. Switcher components shall operate on 120 volts 60 Hz AC power. The switcher central processor unit shall be capable of being interfaced to a master security computer for integrated operation and control. The video switcher central processing unit (CPU) shall have the capability of accepting time from a master clock supplied in ASCII format through an EIA ANSI/EIA/TIA-232-F input. All components, modules, cables, power supplies, software, and other items needed for a complete and operable CCTV switching system shall be provided. Switcher equipment shall be rack mounted unless otherwise specified. Rack mount hardware shall be supplied to mount the switcher components in a standard 19 inch rack as described in EIA ANSI/EIA-310-D.

2.9.1 Switcher Software

The switcher shall be software programmable, and the software shall be supplied as part of the switcher. The software shall be installed in the switcher CPU, and shall be configured as required by the site design. Changes or alterations of features under software control shall be accomplished through software programming without changes in hardware or system configuration. The switcher shall retain the current program for at least 6 hours in the event of power loss, and shall not require reprogramming in order to restart the system.

2.9.2 Switcher Matrix

The switcher shall be a programmable crosspoint switcher capable of switching any video input to any video output. The switcher to be installed at the site shall be configured to switch 2 cameras to 2 monitors, and shall have an expansion capability of not less than 10

percent.

2.9.3 Switcher Modular Expansion

The switcher shall be expandable in minimum increments as specified below.

2.9.3.1 Input Module

Hardware expansion modules shall be provided to expand the switcher matrix configuration in increments of at least 8 camera inputs.

2.9.3.2 Output Module

Hardware expansion modules shall be provided to expand the switcher matrix configuration in increments of at least 4 video outputs.

2.9.4 Alarm Interface

An alarm interface shall be furnished with the switcher. The interface shall be compatible with the ESS alarm annunciation system. The alarm interface shall monitor alarm closures for processing by the switcher CPU. Alarm inputs to the alarm interface shall be relay contact or through an EIA ANSI/EIA/TIA-232-F interface. The alarm interface shall be modular and shall allow for system expansion. The alarm interface to be installed at the site shall be configured to handle 10 alarm points, and shall have an expansion capability of not less than 20 percent. An output shall be provided to actuate a video recorder.

2.9.5 Switcher Response Time and Alarm Processing

The switcher response time shall not be greater than 200 milliseconds from the time the alarm is sensed at the switcher alarm interface, until the picture is displayed on the monitor. The switcher shall continue to process subsequent alarms and shall put them in a queue. The operator shall be able to view the alarms in queue by operating an alarm release function which switches the subsequent alarms to the monitor in the order of occurrence.

2.9.6 Control Keyboards

Control and programming keyboards shall be supplied for the video switcher at the security center, and control keyboards shall be supplied for any control/monitoring stations as shown. The control keyboard shall provide the interface between the operator and the CCTV system, and shall relay commands from the operator to the switcher CPU. The keyboard shall provide control of the video switcher functions needed for operation and programming of the video switcher. Controls shall include, but not be limited to: programming the switcher, switcher control, lens function control, pan/tilt/zoom (PTZ) control, control of environmental housing accessories, and annotation programming. If the switcher CPU requires an additional text keyboard for system management functions, the keyboard shall be supplied as part of the video switcher.

2.9.7 Accessory Control Equipment

The video switcher shall be equipped with signal distribution units, preposition cards, expansion units, cables, software or any other equipment needed to ensure that the CCTV system is complete and fully operational.

2.9.8 Connectors for Video Switcher

Video signal input and output shall be by BNC connectors.

2.9.9 Video Annotation

Video annotation equipment shall be provided for the video switcher. The annotation shall be alphanumeric and programmable for each video source. Annotation to be generated shall include, but not be limited to: individual video source identification number, time (hour, minute, second) in a 24 hour format, date (month, day, year), and a unique, user-defined title with at least 8 characters. The annotation shall be inserted onto the source video so that both shall appear on a monitor or recording. The lines of annotation shall be movable for horizontal and vertical placement on the video picture. The annotation shall be automatically adjusted for date. Programmed annotation information shall be retained in memory for at least 4 hours in the event of power loss.

2.10 VIDEO MULTIPLEXER

The video multiplexer shall be a multi-channel record and playback system with the capability of monochrome and color real time multi-screen viewing.

Electronic components, sub assemblies, and circuits of the multiplexer shall be solid state. The multiplexer, using time division multiplexing, shall permit up to 16 camera inputs to be recorded simultaneously on a single digital video recorder (DVR). All 16 camera inputs shall be capable of being viewed on a video monitor either live or recorded. The multiplexer shall allow for simultaneous viewing, recording playback, and multiplexing (Duplex Operation). The inputs shall be capable of simultaneous viewing on the monitor or full screen individually and in other multi-screen modes such as 2x2, 3x3, 4x4 or other configurations. The viewing format shall also permit 2x dynamic zoom capability, full screen. The multiplexer shall be compatible with EIA/NTSC video cameras and DVRs. External camera synchronization shall not be required for proper operation of the video multiplexer. Control of all functions of the multiplexer shall be provided either by a full function keyboard or by pushbutton selection with on-screen menu driven set-up. The multiplexer shall retain the current program for at least 6 hours in the event of power loss.

2.11 DIGITAL VIDEO RECORDER (DVR)

DVR shall conform to EIA 170 standards. The DVR shall be specifically designed as a time lapse recorder for use in security systems. The DVR shall operate on 120 volts 60 Hz AC power. Resolution of the DVR in normal play mode shall not be less than 350 horizontal lines in monochrome, 300 horizontal lines in color. Signal-to-noise ratio shall not be less than 40 dB. The DVR shall have a condensation or dew circuit. The DVR shall have a built-in time and date generator that can be turned on or off, and shall impose the time and date on the video during recording. A 24 hour battery back-up shall be provided to protect time/date and programmed information. The DVR shall have an audible warning alarm that shall annunciate the end of tape, excessive condensation, tape transport malfunction, or tape jam.

2.11.1 Recording and Playback

The DVR shall be capable of recording for 168 hours or more on a single hard drive. The DVR shall have a contact closure alarm signal input which shall automatically switch the recorder into standard play, record mode

when an alarm is initiated. The DVR shall put a cue mark at the beginning of an alarm event recording. The alarm event record time shall be selectable for up to 3 minutes of automatic recording as a minimum. Playback functions shall include: alarm search, fast forward search, fast rewind search, play, slow motion or step field/frame, and pause/still.

2.11.2 Connectors for DVR

Video signal input and output shall be by BNC connectors. The recorder shall provide connectors for alarm trigger signal input and output.

2.12 VIDEO SIGNAL EQUIPMENT

The following video signal equipment shall conform to EIA 170. Electrically powered equipment shall operate on 120 Volts 60 Hz AC power. All video signal inputs and outputs shall be by BNC connectors.

2.12.1 Video Loss/Presence Detector

The video loss/presence detector shall monitor video transmission lines for presence of the video signal. The detector shall annunciate an alarm when the video signal drops below a pre-set threshold level. A threshold level adjustment shall be provided for each video channel, and the threshold level shall be continuously adjustable through a lockable front panel control. A front panel reset control shall be provided for each video channel, which shall reset the detector after an alarm. The video loss alarm shall be annunciated through a front panel LED and a contact closure as a minimum. Video input shall be loop-through, and the video shall be unaffected when the detector is turned off. The detector shall not attenuate or reduce the level of the video signal passing through it.

2.12.2 Master Video Sync Generator

The master video sync generator shall generate horizontal drive, vertical drive, blanking, and sync signals as a minimum, with at least one 75 ohm output provided for each signal. The master oscillator crystal shall be pre-aged, and temperature stabilized, ovenized or temperature compensated. The sync generator shall have a composite video input and shall lock to the incoming video signal. If no video is present at the video input, the sync generator shall switch to internal crystal control. Not less than 2.5 microseconds advance and 2.5 microseconds delay of horizontal phase shall be provided. Vertical blanking width adjustment shall be provided. Vertical blanking width adjustment shall have a minimum selection range of 19, 20, and 21 lines.

2.12.3 Video Sync Distribution Amplifier

The sync distribution amplifier shall be a regenerative amplifier designed to distribute a sync signal input to not less than 6, 75 ohm outputs. Output level shall remain constant and shall not be affected by input level variations. Output isolation shall be greater than 35 dB at 5 MHz. A high impedance loop through shall be provided in addition to the 6 outputs. The distribution amplifier shall have continuously variable delay range of at least 250 nanoseconds to 2.2 microseconds. The delay shall be adjustable through a front panel control.

2.13 ACCESSORIES

Standard 19 inch electronic rack cabinets conforming to EIA ANSI/EIA-310-D

shall be provided for the CCTV system at the security center and remote control/monitoring sites as shown.

2.14 WIRE AND CABLE

The Contractor shall provide all wire and cable not indicated as Government Furnished Equipment. All wire and cable components shall be able to withstand the environment the wire or cable is installed in for a minimum of 20 years.

2.14.1 CCTV Equipment Video Signal Wiring

The coaxial cable shall have a characteristic impedance of 75 ohms plus or minus 3 ohms. RG 59/U coaxial signal cable shall have shielding which provides a minimum of 95 percent coverage, a solid copper center conductor of not less than 23 AWG, polyethylene insulation, and a black non-contaminating polyvinylchloride (PVC) jacket. RG 6/U coaxial cable shall have shielding which provides a minimum of 95 percent coverage, with center conductor of 18 AWG or larger polyethylene insulation, and a black non-contaminating polyvinylchloride (PVC) jacket. Single mode fiber optic cable shall use for long distance signal transmission.

2.14.2 Low Voltage Control Wiring

Twisted pair low voltage control wiring to be used above ground. Plenum or riser cables shall be IEEE C2 CL2P certified.

2.14.3 Digital Data Interconnection Wiring

Interconnecting cables carrying digital data between equipment located at the security center or at a secondary control/monitoring site shall be not less than 20 AWG and shall be stranded copper wire for each conductor. The cable or each individual conductor within the cable shall have a shield that provides 100 percent coverage. Cables with a single overall shield shall have a tinned copper shield drain wire. Plenum or riser cables shall be IEEE C2 CL2P certified.

2.15 PREDELIVERY TESTING

2.15.1 General

The Contractor shall assemble the test CCTV system as specified, and perform tests to demonstrate that the performance of the system complies with the contract requirements in accordance with the approved predelivery test procedures. The tests shall take place during regular daytime working hours on weekdays. Model numbers of equipment tested shall be identical to those to be delivered to the site. Original copies of all data produced during predelivery testing, including results of each test procedure, shall be delivered to the Government at the conclusion of predelivery testing prior to Government approval of the test. The test report shall be arranged so that all commands, stimuli, and responses are correlated to allow logical interpretation.

2.15.2 Test Setup

The Contractor shall provide the equipment needed for the test setup and shall configure it to provide alarm actuated camera call-up and alarm recording as required to emulate the installed system. The test setup shall consist of at least 4 complete camera circuits. The alarm signal

input to the CCTV test setup shall be by the same method that is used in the installed system. The video switcher shall be capable of switching any camera to any monitor and any combination of cameras to any combination of monitors. The minimum test setup shall include:

- a. Four video cameras and lenses.
- b. Three video monitors.
- c. Video recorder if it is required for the installed system.
- d. Video switcher including video input modules, video output modules, and control and applications software.
- e. Video multiplexer, if required for the installed system.
- f. Alarm input panel if required for the installed system.
- g. Pan/tilt mount and pan/tilt controller if the installed system includes cameras on pan/tilt mounts.
- h. Any ancillary equipment associated with a camera circuit such as equalizing amplifiers, video loss/presence detectors, terminators, ground loop correctors, surge protectors or other in-line video devices.
- i. Cabling for all components.

PART 3 EXECUTION

3.1 INSTALLATION

The Contractor shall install all system components and appurtenances in accordance with the manufacturer's instructions, IEEE C2 and as shown, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system. Raceways shall be furnished and installed as specified in Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and Section 16415 ELECTRICAL WORK, INTERIOR. DTM shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other building wiring. All other electrical work shall be as specified in the above sections including grounding to preclude ground loops, noise, and surges from adversely affecting system operation.

3.1.1 Current Site Conditions

The Contractor shall visit the site and verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Government in a report as defined in paragraph Group II Technical Data Package. The Contractor shall not take any corrective action without written permission from the Government.

3.1.2 Enclosure Penetrations

All enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with

rubber silicone sealant to preclude the entry of water. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer, and in such a manner that the cable is not damaged.

3.1.3 Cold Galvanizing

All field welds and brazing on factory galvanized boxes, enclosures, and conduits shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

3.1.4 Interconnection of Console Video Equipment

The Contractor shall connect signal paths between video equipment with RG-6/U coaxial cable. Cables shall be as short as practicable for each signal path without causing strain at the connectors. Rack mounted equipment on slide mounts shall have cables of sufficient length to allow full extension of the slide rails from the rack.

3.1.5 Cameras

The Contractor shall install the cameras with the proper focal length lens as required for each zone per the CCTV designer; connect power and signal lines to the camera; set cameras with fixed iris lenses to the proper f-stop to give full video level; aim camera to give field of view as needed to cover the alarm zone; aim fixed mount cameras installed outdoors facing the rising or setting sun sufficiently below the horizon to preclude the camera looking directly at the sun; focus the lens to give a sharp picture over the entire field of view; and synchronize all cameras so the picture does not roll on the monitor when cameras are selected. One camera shall be installed per each traffic lane(s) around the gate house and guard houses for viewing the driver of the car. One camera shall be installed per each traffic lane(s) around the gate house and guard houses for viewing the back license plate of the car.

3.1.6 Monitors

The Contractor shall install the monitors in Security Police Center, gate house and as shown; connect all signal inputs and outputs as shown and specified; terminate video input signals as required; and connect the monitor to AC power. Verify the size of monitors are required with the Security Chief and Doim.

3.1.7 Switcher

The Contractor shall install the switcher as shown and according to manufacturer's instructions; connect all subassemblies as specified by the manufacturer and as shown; connect video signal inputs and outputs as shown and specified; terminate video inputs as required; connect alarm signal inputs and outputs as shown and specified; connect control signal inputs and outputs for ancillary equipment or secondary control/monitoring sites as specified by the manufacturer and as shown; connect the switcher CPU and switcher subassemblies to AC power; load all software as specified and required for an operational CCTV system configured for the site requirements, including data bases, operational parameters, and system, command, and application programs; provide the original and 2 backup copies for all accepted software upon successful completion of the endurance test; and program the video annotation for each camera.

3.1.8 Video Recording Equipment

The Contractor shall install the video recording equipment as specified by the manufacturer with the approval of the Contracting Officer; connect video signal inputs and outputs as specified; connect alarm signal inputs and outputs as specified; and connect video recording equipment to AC power.

3.1.9 Video Signal Equipment

The Contractor shall install the video signal equipment as specified by the manufacturer and as shown; connect video or signal inputs and outputs as shown and specified; terminate video inputs as required; connect alarm signal inputs and outputs as required; connect control signal inputs and outputs as required; and connect electrically powered equipment to AC power.

3.1.10 Camera Housings, and Mounts

The Contractor shall install the camera housings and mounts as specified by the manufacturer and as shown, provide mounting hardware sized appropriately to secure each camera, housing and mount with maximum wind and ice loading encountered at the site; provide a foundation for each camera pole as specified and shown; provide a ground rod for each camera pole and connect the camera pole to the ground rod as specified in Section 16375; provide electrical and signal transmission cabling to the mount location as specified in Section 16711; connect signal lines and AC power to mount interfaces; and connect pole wiring harness to camera.

3.2 SYSTEM STARTUP

The Contractor shall not apply power to the CCTV system until the following items have been completed:

- a. CCTV system equipment items and DTM have been set up in accordance with manufacturer's instructions.
- b. A visual inspection of the CCTV system has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
- c. System wiring has been tested and verified as correctly connected as indicated.
- d. All system grounding and transient protection systems have been verified as properly installed and connected as indicated.
- e. Power supplies to be connected to the CCTV system have been verified as the correct voltage, phasing, and frequency as indicated.
- f. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work/equipment.

3.3 SUPPLEMENTAL CONTRACTOR QUALITY CONTROL

The following requirements supplement the contractor quality control requirements specified elsewhere in the contract. The contractor shall provide the services of technical representatives who are thoroughly

familiar with all components and installation procedures of the installed IDS; and are approved by the Contracting Officer. These representatives will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance. These representatives shall also be available on an as needed basis to provide assistance with follow-up phases of quality control. These technical representatives shall participate in the testing and validation of the system and shall provide certification that their respective system portions meet its contractual requirements.

3.4 SITE TESTING

3.4.1 General

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. The Government will witness all performance verification and endurance testing. Written permission shall be obtained from the Government before proceeding with the next phase of testing. Original copies of all data produced during performance verification and endurance testing shall be turned over to the Government at the conclusion of each phase of testing prior to Government approval of the test.

3.4.2 Contractor's Field Testing

The Contractor shall calibrate and test all equipment, verify DTM operation, place the integrated system in service, and test the integrated system. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Government that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure. In addition, the Contractor shall make a master video tape recording showing typical day and night views of each camera in the system and shall deliver the tape with the report. Note any objects in the field of view that might produce highlights that could cause camera blinding. Note any objects in the field of view or anomalies in the terrain which may cause blind spots. Note if a camera cannot be aimed to cover the zone and exclude the rising or setting sun from the picture. Note night assessment capabilities and whether lights or vehicle headlights cause blooming or picture degradation. If any of the above conditions or other conditions exist that cause picture degradation or interfere with the camera field of view, the Contractor shall inform the Contracting Officer. The tape shall be recorded using the video recorder installed as part of the CCTV system. If a recorder is not part of the CCTV system, the Contractor shall provide the tape in Video Home System (VHS) format. The Contractor shall provide the Government with the original tape as part of the documentation of the system and shall submit a letter certifying that the CCTV system is ready for performance verification testing. The field testing shall as a minimum include:

- a. Verification that the video transmission system and any signal or control cabling have been installed, tested, and approved as specified.
- b. When the system includes remote control/monitoring stations or remote switch panels, verification that the remote devices are functional, communicate with the security center, and perform all

functions as specified.

- c. Verification that the switcher is fully functional and that the switcher software has been programmed as needed for the site configuration.
- d. Verification that switcher software is functioning correctly. All software functions shall be exercised.
- e. Verification that video multiplexers are functioning correctly.
- f. Operation of all electrical and mechanical switcher controls and verification that the control performs the designed function.
- g. Verification that all video sources and video outputs provide a full bandwidth signal that complies with EIA 170 at all video inputs.
- h. Verification that all video signals are terminated properly.
- i. Verification that all cameras are aimed and focused properly. The Contractor shall conduct a walk test of the area covered by each camera to verify the field of view.
- j. Verification that cameras facing the direction of rising or setting sun are aimed sufficiently below the horizon so that the camera does not view the sun directly.
- k. If vehicles are used in proximity of the assessment areas, verification of night assessment capabilities and determination if headlights cause blooming or picture degradation.
- l. Verification that all cameras are synchronized and that the picture does not roll when cameras are switched.

The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Government that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.

3.4.3 Performance Verification Test

The Contractor shall demonstrate that the completed CCTV system complies with the contract requirements. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The performance verification test, as specified, shall not be started until receipt by the Contractor of written permission from the Government, based on the Contractor's written report. This shall include certification of successful completion of Contractor Field Testing as specified in paragraph "Contractor's Field Testing," and upon successful completion of training as specified. The Government may terminate testing at any time when the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period as described for Endurance Testing Phase II. Upon successful completion of the performance

verification test, the Contractor shall deliver test reports and other documentation as specified to the Government prior to commencing the endurance test.

3.4.4 Endurance Test

- a. The Contractor shall demonstrate the specified requirements of the completed system. The endurance test shall be conducted in phases as specified. The endurance test shall not be started until the Government notifies the Contractor, in writing, that the performance verification test is satisfactorily completed, training as specified has been completed, and correction of all outstanding deficiencies has been satisfactorily completed. The Contractor shall provide one operator to operate the system 24 hours per day, including weekends and holidays, during Phase I and Phase III endurance testing, in addition to any government personnel that may be made available. The Government may terminate testing at any time the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period as described for Phase II. During the last day of the test the Contractor shall verify the operation of each camera. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the Government prior to acceptance of the system.
- b. Phase I (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized by the Government in writing. If the system experiences no failures during Phase I testing, the Contractor may proceed directly to Phase III testing after receipt by the Contractor of written permission from the Government.
- c. Phase II (Assessment): After the conclusion of Phase I, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the Government. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Government. The meeting shall not be scheduled earlier than 5 business days after receipt of the report by the Government. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate portions of the performance verification test. Based on the Contractor's report and the test review meeting, the Government will determine the restart date, or may require that Phase I be repeated. If the retest is completed without any failures, the Contractor may proceed directly to Phase III testing after receipt by the Contractor of written permission from the Government.
- d. Phase III (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized by the

Government in writing.

- e. Phase IV (Assessment): After the conclusion of Phase III, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the Government. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Government. The meeting shall not be scheduled earlier than 5 business days after receipt of the report by the Government. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by repeating appropriate portions of the performance verification test. Based on the Contractor's report and the test review meeting, the Government will determine the restart date, and may require that Phase III be repeated. The Contractor shall not commence any required retesting until after receipt of written notification by Government. After the conclusion of any retesting which the Government may require, the Phase IV assessment shall be repeated as if Phase III had just been completed.
- f. Exclusions: The Contractor will not be held responsible for failures resulting from the following:
 - (1) An outage of the main power supply in excess of the capability of any backup power source, provided that the automatic initiation of all backup sources was accomplished.
 - (2) Failure of a Government furnished DTM circuit, provided that the failure was not due to Contractor furnished equipment, installation, or software.
 - (3) Failure of existing Government owned equipment, provided that the failure was not due to Contractor furnished equipment, installation, or software.

-- End of Section --